LIBRARY
CURRENT SERIAL RECORD
SEP 27 1956
U. S. DEPARTMENT OF AGRICULTURE

THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
and
IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

Volume 40 Number 9

September 15, 1956

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

THE PLANT DISEASE REPORTER

Issued by

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch — Plant Industry Station, Beltsville, Maryland

Volume 40 — Number 9

September 15, 1956

IN THIS ISSUE

Virus Diseases: Carrot motley dwarf disease, previously known only in Australia, has been identified in California (L. L. STUBBS, page 763). "Dapple apple" is a descriptive name for a fruit symptom observed in one New Hampshire orchard, cause unknown but possibly virus (W. W. SMITH et al., page 765). Cucumber proved superior to several Prunus spp. tested as indexing hosts for stone fruit viruses (R. M. GILMER and K. D. BRASE, page 767).

Urediospores of Tranzschelia discolor developed on peach leaves inoculated at the Plant Industry Station with aeciospores from Anemone coronaria plants sent from Israel (JOHN C. DUNEGAN and ISAAC WAHL, page 771).

It is not known whether the recent occurrence in Florida of brown rot of citrus fruit on the tree is associated with weather or with the possible introduction of fruit-infecting strains of Phytophthora parasitica (L. C. KNORR, page 772).

Chemical control, including antibiotics (See also HORN et al.): Fungicides containing mercury were most effective for control of "ojo de gallo", the most important disease of coffee in Costa Rica (EDDIE ECHANDI, page 775). In greenhouse experiments streptomycin in various formulations gave good control of lima bean downy mildew; better protection resulted from a spray containing equal parts of Agri-mycin 500 and neutral copper than from either component alone (W. J. ZAUMEYER and R. E. WESTER, page 776). Vapam applied as a soil fumigant controlled the early maturity disease of potatoes effectively but its present cost makes its use impractical except for high acre-value crops (ROY A. YOUNG, page 781). Eighteen different fungicides were tested in the 1955-56 seed-treatment trials for control of oat smuts and wheat bunt (R. W. LEUKEL and R. W. EARHART, page 785). Thiram and dichlone gave better field control of strawberry gray mold in Connecticut than captan (P. M. MILLER and E. M. STODDARD, page 788).

Nematodes: In Louisiana the occurrence and pathogenicity of nematodes in commercial strawberry growing areas and effects of soil fumigation on nematode populations and on fruit yields were investigated (N. L. HORN et al., page 790). Meloidogyne javanica is most widespread of the five root-knot nematodes so far known to be present in Israel; hosts are listed for all five (G. MINZ, page 798).

Cotton leaf scald apparently is associated with midday rain showers followed by bright sunshine (C. H. ARNDT, page 802).

Forage Crops: Two previously unrecognized diseases of blue lupine in the Southeast are caused by species of Stemphylium: little leaf spot by S. botryosum, gray leaf spot by S. solani (HOMER D. WELLS et al., page 803). Forage legumes and grasses were generally less severely affected by diseases in 1956 than in previous surveys in New York (D. A. ROBERTS and C. H. WARD, page 807).

The distribution and relative prevalence of the physiologic races of oat crown rust identified in 1955 are listed (M. D. SIMONS, page 810).

Culture Techniques: An effective technique for isolating and growing Rhynchosporium secalis is described (RICHARD D. SCHEIN and JOHN W. KERELO, page 814). Addition of streptomycin sulfate and cycloheximide to the culture medium inhibits growth of contaminants and aids identification of the Dutch elm disease organism (I. R. SCHNEIDER, page 816).

Tree Diseases: Sampling of suspected oak wilt trees by means of the increment hammer is easier than by the usual pruning or chopping methods (JOHN S. BOYCE, Jr., page 822). Extent of infection in bottomland red oak trees two years after inoculation with three different species of heart-rotting fungi is reported (E. RICHARD TOOLE, page 823). Oak trees with roots decayed by Polyporus dryadeus may be more susceptible than unaffected trees to unfavorable environmental conditions (CHARLES L. FERGUS, page 827).

Unusual Records and Other Brief Notes, page 830: Soybean cyst nematode identified in North Carolina (JOSEPH F. SPEARS et al). Bacterial leaf spot of alfalfa in Iowa (RAYMOND D. BRIGHAM). Alta fescue, a new host for Sclerophthora macrospora (TIMOTHY A. GASKIN and MICHAEL P. BRITTON). Camellia flower blight in South Carolina (L. W. BAXTER and J. A. BERLY). Proper citation of the bean anthracnose fungus (JOHN A. STEVENSON).

Attention Please! -- Annual Report of the Canadian Plant Disease Survey, for 1955, page 832.

A correction, page 832. July weather, page 833. Manuscripts for the REPORTER, page 834.

Vol. 40, No. 9--PLANT DISEASE REPORTER--Sept. 15, 1956

MOTLEY DWARF VIRUS DISEASE OF CARROT IN CALIFORNIA

L. L. Stubbs [1, 2]

The motley dwarf virus disease of carrot (2, 3), hitherto believed to occur only in Australia, has been identified by the writer in California.

The presence of a virus disease on carrot, which differed from those previously described in the United States, had been recognized by Dr. R. G. Grogan, University of California, Davis, who had corresponded with the writer regarding its possible identity with the Australian disease. Dr. Grogan had transmitted the disease by grafting and had also postulated that the necrotic shock symptoms which sometimes occur after infection, particularly on vigorously growing seed plants, could have been confused with symptoms attributed to the bacterial blight disease (1).

The disease was first seen by the writer in the United States at Patterson in the San Joaquin Valley, California. It has since been found at Davis, in the Salinas area, and as far south as Oxnard in Ventura County. Mature root crops inspected during mid-March in the Imperial Valley appeared to be healthy.

The effect of the disease on seed-fields inspected at Milpitas and Salinas was as severe as on seed crops in Australia (2). Two small fields of susceptible varieties were 100 percent infected. The foliage of plants in these fields was intensely mottled, with characteristic anthocyanin pigmentation of the older leaves. The plants were severely dwarfed and mortality had been high.

In a seed field crop at Davis less than 50 percent of the plants were infected. As the insect vector, Cavariella aegopodii (syn. C. caprea), was present, the disease was continuing to spread, and good examples of the leaf scorching and necrotic stem streaking shock symptoms were seen.

In root crops in the Salinas Valley the disease was less easy to detect due largely to the cultural practice of heavy seeding in bands, with which the writer was not familiar. Under such crowded growth conditions during a period of rising temperatures, foliage mottling does not develop to the same extent, and the general impression is a paler green than is normal for the foliage of healthy crops. In one large field a very high proportion of the plants was affected.

In all fields which the writer has seen, particularly root crops, the vector population has been low. This was particularly evident in the Salinas fields and these fields had not been treated with insecticides. In Australia the aphid vector usually occurs in enormous numbers unless insecticidal treatment is regularly applied.

Aphids collected in the field for transmission studies at Berkeley have multiplied at a very slow rate on the carrots they originally infested, due to heavy parasitism with a Braconid wasp. The writer does not recall ever having seen a parasitized C. aegopodii aphid in Australia.

This observation, coupled with the fact that the rate of virus spread appears to be much slower in California than in Australia, suggests that the vector may be in equilibrium with its California environment due to the effect of the parasite and possible predators.

Thus, there would appear now to be reasonable grounds for doubting that the carrot motley dwarf virus originated in Australia, as previously believed.

At Berkeley the virus has been experimentally transmitted by aphid from carrot to carrot in serial transfers with C. aegopodii. In the experiment recorded in Table 1, which was the only one the writer had the opportunity to conduct due to his impending departure from California, Chantenay carrot seedlings in the cotyledonary leaf stage were caged with groups of 10 aphids bred on infected carrots. One day later the survivors were transferred to a further series of plants for the same test feeding period. Controls in this experiment, which were grown in the same pots with inoculated plants for better comparison, were not subjected to aphids due to a shortage of non-infective aphids. However, 5 plants not referred to in Table 1 were caged with groups of 20 C. aegopodii aphids bred on celery, which is immune from the virus, and 5 with aphids from the same source which were given a 24-hour access feed on a carrot seed plant infected with aster yellows. As expected, these plants did not show disease symptoms or any deleterious effect from the aphids' feeding, as carrot, unlike celery, is extremely tolerant of heavy populations of C. aegopodii aphids.

Epinasty symptoms were observed on the cotyledonary leaves of the inoculated plants 10 days after inoculation. These symptoms were recorded, but as the test plants were still very

---

1 Senior Plant Pathologist, Department of Agriculture, Victoria, Australia, and Commonwealth Fund Fellow, Department of Plant Pathology, University of California, Berkeley.

2 The writer acknowledges the helpful advice and assistance of Dr. J. H. Freitag, Department of Entomology and Parasitology, University of California, Berkeley, and of Dr. R. G. Grogan, Department of Plant Pathology, University of California, Davis, during this investigation.

Table 1. Transmission of carrot motley dwarf virus by C. aegopodii to Chantenay carrot seedlings.

Virus source	Numbers of plants			
	Transfer 1		Transfer 2	
	Diseased	Healthy	Diseased	Healthy
Carrot 1	2	0	2	0
Carrot 2	2	0	2	0
Carrot 3	2	0	2	0
Carrot 4	1	--	1	--
Carrot 5	1	--	1	--
Carrot 6	2	0	2	0
Carrot 7	1	--	1	--
Carrot 8	1	--	1	--

small, they were not regarded as proof of virus transmission. Two weeks later, however, these plants showed unmistakable symptoms of the motley dwarf disease.

An attempt was made to aphid-inoculate Turkish tobacco and Datura stramonium plants with the virus but symptoms failed to develop. However, optimum conditions such as high virus concentration in the source plant, small test plants, and cool temperature conditions must prevail before the virus can be transferred by the vector to non-umbelliferous hosts (3). It is possible also that the Turkish variety of tobacco and the strain of D. stramonium used were not susceptible to the virus, as these differed from the varieties used in the writer's experiments in Australia.

For rapid identification of the virus, Apium leptophyllum (syn. A. ammi), a delicate umbelliferous plant native to Australia, is an excellent indicator. Severe epinasty and lower leaf and stem necrosis followed by death, or almost complete cessation of growth, occurs on inoculated plants. These symptoms are not subject to temperature masking as sometimes occurs in carrot (2). Unfortunately, plants of this variety were not available in time for the writer's experiments at Berkeley.

Literature Cited

1. Kendrick, J. B. 1934. Bacterial blight of carrot. Jour. Agr. Res. 49: 493-510.
2. Stubbs, L. L. 1948. A new virus disease of carrot: its transmission, host range, and control. Australian Jour. Sci. Res. Ser. B. 1: 303-332.
3. Stubbs, L. L. 1952. Further host range and transmission studies with a virus disease of carrot endemic in Australia. Australian Jour. Biol. Sci. 5: 399-408.

DEPARTMENT OF PLANT PATHOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY 4, CALIFORNIA

DAPPLE APPLE, AN UNUSUAL FRUIT SYMPTOM OF APPLES IN NEW HAMPSHIRE [1]

W. W. Smith, J. G. Barrat and A. E. Rich [2]

Summary

Apples from a number of Cortland and McIntosh trees in one orchard do not color properly when they ripen. As the fruit matures, more or less circular patches of skin remain green and fail to develop the continuous coloring typical of the Cortland and McIntosh varieties. The surface of the fruit is slightly distorted in that the blotchy areas are somewhat flattened. The bloom on the surface of the affected fruits of the Cortland variety is reduced in the blotchy areas while on affected McIntosh apples the bloom is not reduced. In storage the green areas turn yellow. With the exception of two trees with Robusta V interpieces, all affected trees have Virginia Crab interpieces. The name dapple apple is suggested for this disorder.

In the fall of 1953, an unusual coloring was observed on apples produced by several Cortland trees in one orchard. Instead of coloring uniformly, more or less circular islands or patches of the skin remained green. The surface of the fruit at these green areas was slightly flattened and the bloom was reduced, causing a dappled appearance of the apple (Fig. 1). The

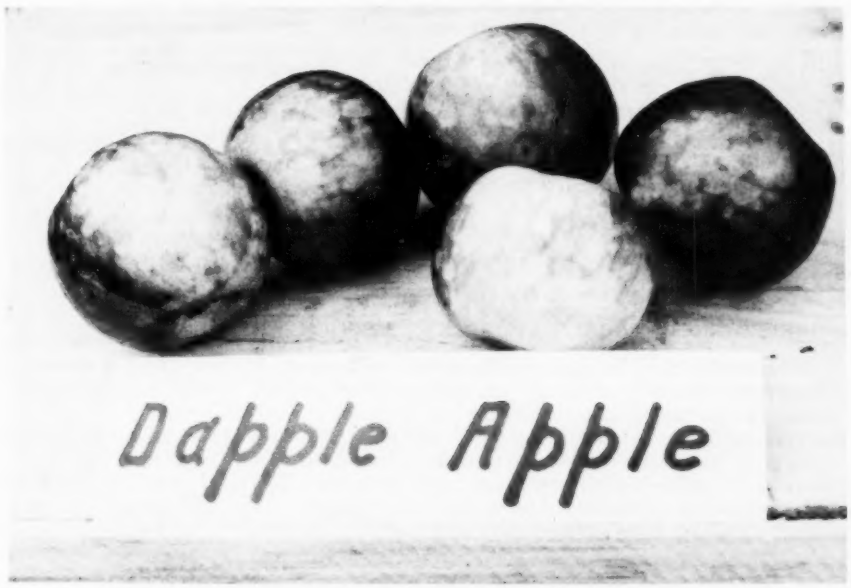


FIGURE 1. Apples from Cortland tree showing typical dappled appearance due to lack of normal color development as the fruits ripen.

---

[1] Published with the approval of the Director of the New Hampshire Agricultural Experiment Station as Scientific Contribution No. 191.

[2] Associate Horticulturist, Research Assistant in Botany, and Plant Pathologist, respectively, New Hampshire Agricultural Experiment Station.

spots appear generally over the surface of the fruit tending to be more concentrated at the calyx end. The apples were harvested and placed in storage, where after a few weeks it was noticed that the blotchy areas had turned a pale yellow. The trees that produced these dappled fruits in 1953 showed the same symptoms in 1954 and 1955. All the apples on a tree show the same symptoms in varying degrees. Affected apples are unsalable. The symptoms on the McIntosh variety were first noticed in 1954 and are similar to but less pronounced than symptoms on Cortland. The bloom on McIntosh is not reduced in the affected areas. No leaf symptom has, as yet, been associated with the dapple apple disorder.

This fruit symptom is distinct from blotch (3) due to Phyllosticta solitatia Ell. & Ev., as no fungus appears to be associated with it, and it does not become conspicuous until the apples commence to ripen in the fall. Pansy spot (3), caused by thrips (Frankliniella tritici Fitch), bears some resemblance to this type of symptom. However, it usually shows up most on green fruit and becomes less conspicuous as the apples ripen.

Recently Palmiter and Parker (2) demonstrated that green mottle of Duchess apples in New York could be transmitted by grafting. Experiments are now in progress to determine whether or not the causal agent of dapple apple can be transmitted by budding or grafting.

A distinctly different symptom has been described recently on Red Delicious in Missouri (1), in association with Virginia Crab. Pitting of Virginia Crab interstocks has been noted in the same orchard where dapple apple occurs (4). However, an association between these two disorders has not been established. Pitting of the Virginia Crab interpiece has been observed on trees where the fruit colors normally, as well as on some of the trees which produce dapple apple.

Dapple apple has been observed only on trees with Virginia Crab or Robusta V bodystocks. It has not been observed on nearby trees with Florence Crab bodystocks or Malling IV and seedling understocks.

Literature Cited

1. Millikan, D. F., and W. R. Martin. 1956. An unusual fruit symptom in apple. Plant Dis. Reptr. 40: 229-230.
2. Palmiter, D. H., and K. G. Parker. 1955. Transmission of the causal agent of apple green mottle. (Abs.) Phytopathology 45: 186.
3. Rose, D. H., C. Brooks, D. F. Fisher, and C. O. Bratley. 1933. Market diseases of fruits and vegetables. Apples, Pears, Quinces. U. S. Dept. Agr. Misc. Publ. 168.
4. Smith, W. W. 1954. Occurrence of "stem-pitting" and necrosis in some body stocks for apple trees. Amer. Soc. Hort. Sci. Proc. 63: 101-113.

NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION

THE COMPARATIVE VALUE OF VARIOUS INDEXING HOSTS IN DETECTING STONE FRUIT VIRUSES[1]

R. M. Gilmer and K. D. Brase[2]

Summary

A comparison of six species of Prunus as indexing hosts for detecting the presence of viruses in 126 individual isolates containing one or more stone fruit viruses demonstrated that none of the Prunus indexing hosts detected the presence of viruses in all instances. Under greenhouse conditions, peach seedlings were inferior as indexing hosts, while Shiro plum and Nanking cherry were of intermediate value. Montmorency sour cherry, Albion plum, and Shirofugen flowering cherry were superior to the other Prunus indexing hosts and gave essentially equal numbers of positive virus indexes[2]. Individual isolates did not always index alike on these three indexing hosts. Cucumber seedlings inoculated in the cotyledonary stage with juice extracts obtained from peach indexing plants were superior to any of the Prunus hosts in revealing the presence of viruses. Three virus isolates that failed to produce positive indexes on any of the Prunus indexing hosts gave positive virus indexes on cucumber seedlings.

INTRODUCTION

Certain economically important stone fruit viruses produce only transient symptoms in many commercial stone fruit varieties. Others are latent following the acute stages of infection or produce symptoms of an indeterminate type that render identification difficult. At the time scionwood is selected for the propagation of new nursery trees, the distinctive symptoms of such important diseases as sour cherry yellows, necrotic ring spot, and green ring mottle are absent.

Several States have instituted an indexing procedure to ensure that scionwood used for propagation of important stone fruit varieties is virus-free. Indexing procedures in current use depend essentially upon the production of visible acute virus symptoms in some species of Prunus following budding with the scionwood being indexed. If evident virus symptoms appear on the indexing plants, the scionwood is rejected as virus-infected, but if none appear, the scionwood under index is assumed to be virus-free. This system of indexing is predicated upon two assumptions: that the indexing plants used for virus detection are themselves virus-free, and that they will respond to virus inoculation with visible symptoms.

Viruses of the sour cherry yellows and necrotic ring spot complexes are seed-transmissible, and an appreciable number (5 to 15 percent) of the seedlings derived from infected bearing trees may be latently infected (2, 3). Indexing on seedlings already infected with a latent virus may falsely result in negative indexes. To minimize this source of error, scionwood is indexed on two or more individual indexing plants. Routine indexing thus requires large numbers of indexing plants, which, ideally, should be derived from sources known to be virus-free.

Numerous species of Prunus have been used as indexing hosts by experimental workers in the various States. In the Northeast, routine indexing is usually carried out on peach seedlings in the field, as advocated by Hildebrand (5). Peach is also used in Michigan (1). In Wisconsin, Montmorency sour cherry is the indexing host of choice (7), while on the Pacific Coast, the flowering cherry varieties Shirofugen and Kwanzan are extensively used (6). Fink reported that Nanking cherry (P. tomentosa Thunb.) was a satisfactory indexing host in Iowa, and that it, in some instances, detected the presence of viruses not determined from parallel indexing on Elberta peach (4).

EXPERIMENTATION AND RESULTS

In the course of studies with 126 isolates, each containing one or more stone fruit viruses,

[1] Approved by the Director as Journal Paper No. 1046, New York State Agricultural Experiment Station, Geneva, New York.

[2] The terms "positive index" and "positive virus index" indicate that visible symptoms of virus infection appeared on the indexing plants.

FIGURE 1. A positive virus index produced on Shirofugen flowering cherry by Wisconsin isolate Goldman 20-5. Note gumming and necrosis at the points where the two index buds were inserted. FIGURE 2. A false negative virus index produced on Shirofugen flowering cherry by Missouri isolate CMS-813. Union of the two indexing buds is normal. This isolate indexes positively on Montmorency cherry and on cucumber.

collected from nine States and from Canada, the individual isolates were indexed in the greenhouse on peach and Nanking cherry seedlings and on budlings of Montmorency sour cherry, Shiro plum, and Albion plum. The isolates were also indexed on 3-year-old trees of Shirofugen flowering cherry in the field.

Indexing plants in the greenhouse were budded at or immediately after budbreak and were maintained at temperatures of 75° F days and 55° F nights for a 6-week period after budding. Shirofugen indexing plants were budded in the field in mid-June, a time when the indexing plants were actively growing. Index readings were made on wilting of the budded terminals and on necrosis and gummosis at the inoculation sites 5 weeks after budding (Figs. 1, 2).

All but three of the 126 virus isolates tested indexed positively on at least one of the Prunus hosts. Twelve isolates gave a positive index on only one of the Prunus indexing hosts, and 11 additional isolates indexed positively on only two of the Prunus indexing hosts. The comparative efficiency of the various indexing hosts in detecting the presence of viruses is given in Table 1. Montmorency sour cherry, Shirofugen flowering cherry, and Albion plum gave essentially equivalent numbers of positive virus indexes, although they did not necessarily detect identical isolates in every case. Shiro plum and Nanking cherry were slightly less efficient in detecting viruses, and peach seedlings were decidedly inferior.

Approximately 6 weeks after the index budding, the peach indexing plants were tested for virus content by mechanical inoculation of cucumber cotyledons (var. National Pickling) with

Table 1. Comparison of the number of positive virus indexes obtained with various indexing hosts.

Indexing host	Number of isolates tested	Number of positive indexes	Percentage positive indexes
Peach	126	37	29
Montmorency	126	115	91
Shirofugen	99	87	88
Nanking cherry	126	101	80
Albion	93	80	86
Shiro	126	96	76
Cucumber	126	126[a]	100

[a] Includes three isolates that failed to index positively on any of the Prunus indexing hosts.

their leaf juice extracts. Although only 37 of the virus isolates had produced a positive index on the peach seedlings, the entire group of 126 isolates indexed positively from peach on cucumber seedlings (Table 1). Less extensive juice transmissions were made from Albion and Shiro plum budlings that had failed to show visible virus symptoms within 6 weeks after index budding, and, in each case. a positive index was obtained on cucumber seedlings. Positive indexes on cucumber seedlings were also obtained from 8 of 11 Montmorency indexing plants that had failed to show virus symptoms following index budding. Attempted virus transmissions to cucumber seedlings from leaves of Nanking cherry were uniformly unsuccessful in a total of 52 trials, regardless of whether the plants had shown virus symptoms following index budding or not.

DISCUSSION

These data are convincing evidence that no single Prunus indexing host in common use is infallible in detecting the presence of viruses even if the latter are present in scionwood under ndex. Neither Montmorency sour cherry, Shirofugen flowering cherry, nor Albion plum, the hree most efficient Prunus indexing hosts tested, detected virus content in all of the 126 stone fruit virus isolates tested. Each gave from 10 to 15 percent false negative indexes. Three isolates, in which the presence of virus was not detected by any of the six Prunus indexing hosts, indexed positively on cucumber seedlings, which also detected the presence of viruses in the remaining 123 isolates.

Cucumber seed is easily obtainable in bulk and can be conveniently stored. Cucumber seedlings can be quickly and readily grown at any time of the year, and give a rapid index within a period of 5 to 8 days after cotyledonary inoculation. They are apparently sensitive to viruses or virus strains that do not produce evident virus symptoms in many Prunus indexing hosts. Cucumber is not a reliable indexing host for detecting virus content in all Prunus species, however, possibly because of the presence of powerful virus inhibitors present in the young leaf tissue of some species. Cucumber does, however, appear to be highly reliable for indexing many important commercial stone fruit varieties such as Montmorency sour cherry, several sweet cherry varieties, peaches, and most plums.

Literature Cited:

1. Cation, D. 1942. Cherry yellows in Michigan. Michigan State Hort. Soc. Ann. Rept. 72: 115-116.

2. Cation, D. 1949. Transmission of cherry yellows complex through seeds. Phytopathology 39: 37-40.
3. Cochran, L. C. 1946. Passage of ring spot virus through mazzard cherry seeds. Science 104: 269-270.
4. Fink, H. C. 1955. Prunus tomentosa as an index plant for sour cherry viruses. Phytopathology 45: 320-323.
5. Hildebrand, E. M. 1942. Indexing cherry yellows on peach. Phytopathology 32: 712-719.
6. Milbrath, J. A., and S. M. Zeller. 1945. Latent viruses in stone fruits. Science 101: 114-115.
7. Moore, J. D., and G. W. Keitt. 1949. An indexing method for necrotic ring spot and yellows of sour cherry. (Abs.) Phytopathology 39: 15-16.

DEPARTMENTS OF PLANT PATHOLOGY AND POMOLOGY,
NEW YORK STATE AGRICULTURAL EXPERIMENT STATION,
GENEVA, NEW YORK

INOCULATIONS WITH AECIOSPORES OF TRANZSCHELIA DISCOLOR FROM ISRAEL

John C. Dunegan[1] and Isaac Wahl[2]

In 1953 Dunegan, Ramsfjell and Gjaerum[3] found that urediospores of Tranzschelia discolor (Fckl.) Tranz. & Litv. from sori on leaves of Prunus insititia collected near Rogaland, Norway, would infect peach (P. persica) leaves in the United States. It is evident therefore that the uredial stage of T. discolor in Europe represents the same species as the rust common on peach in the United States.

In 1954 additional information was obtained on the distribution of T. discolor. Rust-infected Anemone coronaria plants were collected at Naan, Israel, on February 12 and sent by air mail, under a Plant Quarantine Permit, to Plant Industry Station, Beltsville, Maryland. Aeciospores from this material were used on February 26 to inoculate[4] leaves of the peach and the capulin cherry (P. serotina). The aeciospores infected the peach leaves and urediospores developed after 19 days. No infections developed on the capulin cherry leaves. Previous experiments had shown that urediospores of T. discolor from the United States would not infect this cherry.

A. coronaria is indigenous in countries bordering the Mediterranean Sea and in 1945 Zwirn-Hirsch[5] reported that A. coronaria plants throughout Palestine were commonly infected with the aecial stage of a rust. When she inoculated almond and apricot (P. communis and P. armeniaca) leaves with aeciospores from this rust on the native A. coronaria plants, she obtained uredia and telia. Since almond and apricot are the common hosts of T. discolor her work indicated that the aecial stage of T. discolor existed in Palestine on indigenous A. coronaria plants.

The present inoculation experiments add peach to the hosts that can be infected by aeciospores of the rust on the indigenous form of A. coronaria growing in Israel. This is additional evidence that the rust T. discolor is cosmopolitan in its distribution.

UNITED STATES DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, PLANT INDUSTRY STATION, BELTSVILLE, MARYLAND; AND
FACULTY OF AGRICULTURE, THE HEBREW UNIVERSITY, REHOVOT, ISRAEL

---

[1]Principal Pathologist, Fruit and Nut Crops Section, Horticultural Crops Research Branch, Agricultural Research Service, Plant Industry Station, United States Department of Agriculture, Beltsville, Maryland.

[2]Lecturer of Plant Pathology, Faculty of Agriculture, The Hebrew University, Rehovot, Israel.

[3]Dunegan, J.C., T. Ramsfjell, and H. B. Gjaerum. 1953. Inoculations with urediospores of Tranzschelia discolor (Fckl.) Tranz. & Litv. from Norway. Plant Dis. Reptr. 37: 88.

[4]All inoculation experiments with spores from foreign sources are done in the laboratory on detached leaves floating on a sugar solution. This procedure protects against possible introduction of new strains into the United States.

[5]Zwirn-Hirsch, H. E. 1945. Infection experiments with aeciospores of Tranzschelia prunispinosae (Pers.) Diet. in Palestine. Palestine Journal of Bot. (Jerusalem series) III: 178-179.

PROGRESS OF CITRUS BROWN ROT IN FLORIDA, A DISEASE OF RECENT OCCURRENCE IN THE STATE[1]

L. C. Knorr[2]

Brown rot of citrus fruits on the tree was first discovered in Florida on the East Coast in 1951. The year following, it was observed on Merritt Island, some 75 miles to the north. In 1953, besides reappearing on the East Coast, brown rot was discovered in Hendry County, 100 miles to the southwest. No further spread occurred in 1954, but on the 15th of September, 1955, an outbreak of brown rot was reported from Hardee County near the southern limits of the Ridge. This represents a first report of the disease in the vicinity of the Ridge, which is the chief citrus-producing area in the State.

Brown rot was also discovered during the second week of October, 1955, in the Ft. Pierce area. Two groves, both with histories of brown rot, were found infected.

Annual losses from brown rot have varied over the 5-year period in which the disease has been present. Following limited activity during 1951 and 1952, in the course of which only two or three groves were involved, the disease assumed considerable importance in 1953, invading 15 to 20 groves in the area between Ft. Pierce and Wabasso. As much as 90 percent of the crop was lost from individual trees and up to 30 percent in the aggregate in some groves. In 1954, very little brown rot occurred in these groves; in fact, of 14 groves included in a brown rot spray experiment -- all with previous histories of brown rot -- only two were attacked with sufficient severity to yield usable data on control. So far in the 1955 season, brown rot has appeared in the Wauchula area of Hardee County, where it was found to be affecting approximately 15 percent of the crop in a 10-acre block of sweet oranges. It has also shown up in two East Coast groves; damage in both locations was slight.

Prior to 1951, it was generally felt that brown rot was absent from Florida. The extent of this feeling is indicated by the passage, in 1927, of a Florida State Plant Board quarantine that sought to prevent introduction of this disease from California.

In 1931 the late H. S. Fawcett visited Florida to ascertain the presence of brown rot in the State, and reported finding the causal fungus in citrus fruits lying on the ground (1). This discovery, however, was not considered to affect validity of the quarantine since the fungus was found only under saprophytic circumstances. It was not until 1954, one year after the report of finding brown rot in fruits on the tree, that the quarantine was finally lifted.

Phytophthora parasitica Dastur was found to be responsible for the outbreak of brown rot in Hardee County as was the case in the Florida outbreaks reported previously (3). This fungus is characterized by ability to grow well at relatively high temperatures -- near 96°F. The eight other species reported elsewhere in the world to cause brown rot (Phytophthora citrophthora, P. cactorum, P. boehmeriae, P. megasperma, P. cinnamomi, P. palmivora, P. syringae, and P. hibernalis), grow poorly or not at all at 96°F, thriving only at much lower temperatures (2). Affected fruits collected from brown rot outbreaks on the East Coast, in Hendry Country, and in Hardee County, when incubated in moist chambers at various temperatures ranging from 85° to 40°, showed greatest increase in extent of rot at 85°. Fruiting of the fungus took place overnight at this temperature, but not at 50° or 40°, even after 7 days. Sporangia were produced in abundance on affected fruits when incubated in containers held at humidities somewhat less than the saturation point. Sporangia were of the same size as those reported elsewhere; measurements taken of 35 sporangia fell within a size range of 31-53 x 19-26 microns, with 46 x 23 microns being the average.

The outbreak of brown rot under conditions that prevailed in Hardee County during September 1955 is illustrative of the fact that moisture is pre-requisite to infection, but this cannot be gauged by inches of rainfall. Precipitation for the area during the month of September, 1955, was below normal; in fact, there has been a marked deficiency in rainfall during this period for the past 2 years. An inspection of hygrothermographic records for 1954 (a non-brown-rot year) and 1955 (a brown-rot year) reveal, however, that fruits were wet for a much longer period of time in September 1955 than for the same period of 1954. The accompanying figure (Fig. 1). shows that for the first 22 days of the month, fruits remained wet a total of 176.5 hours in 1954 and a total of 268 hours in 1955. On an average, fruits were wet 8 hours daily in 1954 and 12 hours daily in 1955. Further, in September of 1954 there were no days during which fruits were wet for more

---

[1]Florida Agricultural Experiment Station Journal Series, No. 503.

[2]Associate Plant Pathologist, Citrus Experiment Station, University of Florida, Lake Alfred, Florida.

Approximate length of time during which citrus fruits were wet during September 1954 (a non-brown-rot year) and September 1955 (a brown-rot year.)

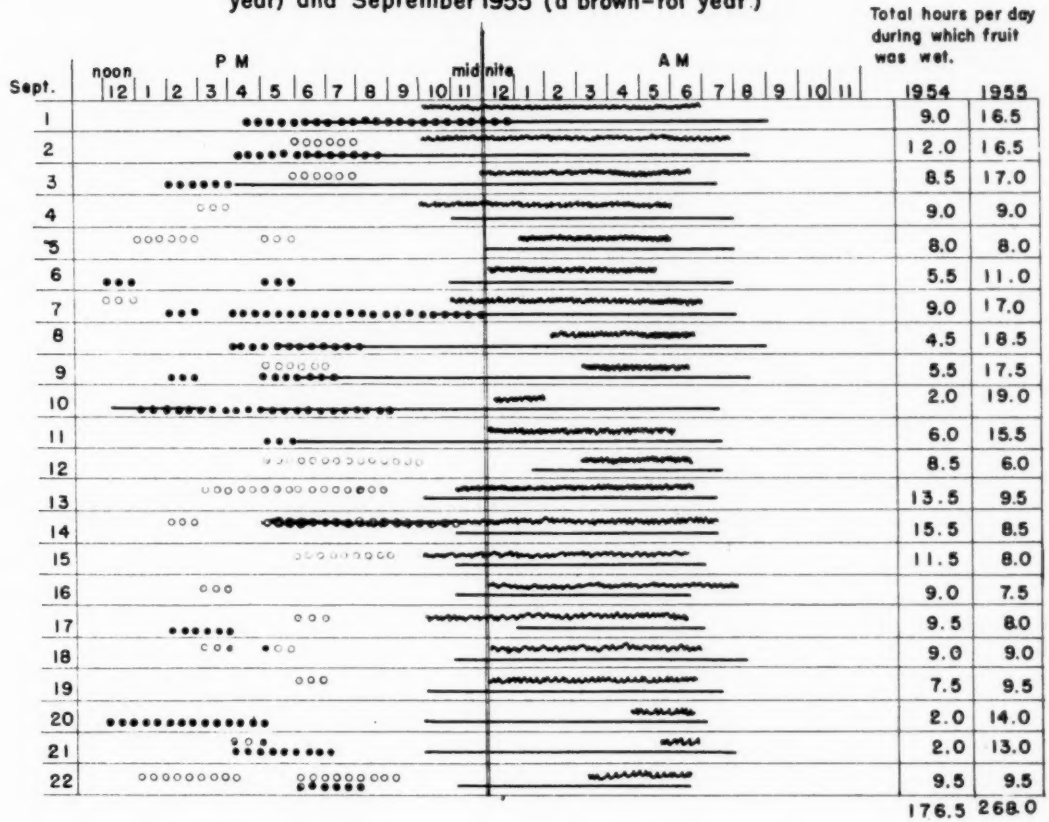


FIGURE 1.

than 15 hours; in 1955, on the other hand, there were 8 days when fruits remained continuously wet 15 hours a day or more.

Continuous rains that precede or follow hurricanes may also provide the wet period required for Phytophthora fungi to invade citrus fruits. This was the case in the outbreak in Hendry County in 1953, which followed on the heels of Hurricane Hazel that passed over the area October 9. In the case, too, of the outbreak on the East Coast in 1953, the disease appeared after unusually heavy and persistent rains.

It is not known whether the recent occurrence in Florida of brown rot is a result of changes in the weather that are now providing organisms long present with sufficient moisture to attack fruits on the tree, or whether fruit-attacking strains have lately been introduced into the State.

Literature Cited

1. Fawcett, H. S. 1933. New locations for Phytophthora citrophthora and P. hibernalis on Citrus. Phytopathology 23: 667-669.
2. Frezzi, M. J. 1950. Las especies de "Phytophthora" en La Argentina. Revista de Inv. Agric. (Argentina) 4 (1): 47-133.
3. West, E., M. Cohen, and L. C. Knorr. 1954. Brown rot of citrus fruit on the tree in Florida. Plant Dis. Reptr. 38: 120-121.

CITRUS EXPERIMENT STATION OF THE UNIVERSITY OF FLORIDA

INHIBITION OF GEMMAE (CABECITAS) PRODUCTION OF MYCENA CITRICOLOR ON COFFEE TREES

Eddie Echandi [1]

"Ojo de gallo" incited by Mycena citricolor (Berk. & Curt.) Sacc. is the most important disease of coffee trees in Costa Rica. The organism produces brown necrotic spots on leaves, young twigs, and fruits, resulting in the diseased leaves and fruits falling to the ground. The organism is transmitted by infection bodies called gemmae or "cabecitas" carried by splashing rain drops. During the dry season spread of the disease is kept to a minimum, but the fungus maintains itself alive in the infected spots till the next rainy season. At this point the fungus starts to fruit again and the old lesions become the main source of primary inoculum.

Although copper-containing fungicides control the disease to a certain extent during the periods of low precipitation, they do not seem to be effective in certain areas during the peak of the rainy season. Experiments were started in the laboratory to find fungicides that would inhibit the production of "cabecitas" in the spots, thereby eliminating the source of primary inoculum. The following fungicides were used: Cupravit (copper oxychloride), Perenox (cuprous oxide), Tri-basic (basic copper sulfate), Crag (copper zinc chromate), Orthocide 50 Wettable (captan), Thylate (TMTD), Elgetol (sodium 4, 6-dinitro-o-cresoxide), Emmi (N-ethylmercury-1, 2, 3, 6-tetrahydro-3,6,-methano-3, 4, 5, 6, 7, 7-hexachloro-phthalamide), Phyx (phenylmercury acetate), Puratized Agricultural Spray (tris(2-hydroxyethyl) (phenylmercuri) ammonium lactate). Coffee leaves with lesions were submerged for a few seconds or sprayed with the fungicides at various concentrations. A few drops of Du Pont spreader sticker were added to the mixture after treatment. The leaves were left to drain a few seconds and then placed in a moist chamber

A week after treatment the leaf spots were examined for the presence of "cabecitas". The results of a typical experiment are shown in Table 1. Mercury compounds inhibit production of "cabecitas" in the leaf spots. Leaf spots treated with copper, or any of the other fungicides except the ones containing mercury, produced "cabecitas" in abundance. Field experiments under way seem to corroborate the laboratory results.

Very little or no phytotoxicity was noticed on coffee trees sprayed with mercury-containing fungicides at concentrations that would inhibit "cabecita" formation.

Table 1. Typical results of "cabecita" inhibition by fungicidal treatments of coffee leaf spots caused by Mycena citricolor.

Treatment	Concentration in grams per liter	Number spots counted	Percent spots with "cabecitas"	Number "cabecitas" per spot
Crag	2.4	56	42.0	1.6
Perenox	3.5	60	48.2	2.1
Cupravit	5.0	49	27.1	1.8
Tri-basic	4.8	86	47.4	2.1
Orthocide	2.4	81	26.5	2.6
Thylate	2.4	73	28.0	1.5
Elgetol	1.0	83	1.0	1.0
Emmi	1.0	74	0.0	0.0
Phyx	1.0	94	0.0	0.0
Puratized Agricultural Spray	1.0	71	0.0	0.0
Control	---	108	62.4	2.9

UNIVERSITY OF COSTA RICA, SAN JOSÉ, COSTA RICA

[1] Professor of Plant Pathology, University of Costa Rica, San José, Costa Rica

CONTROL OF DOWNY MILDEW OF LIMA BEANS WITH STREPTOMYCIN

W. J. Zaumeyer and R. E. Wester [1]

Summary

Agri-mycin 100, Agristrep, and Phytomycin sprays gave excellent control of lima bean downy mildew, caused by Phytophthora phaseoli, in greenhouse tests. At a concentration of 100 p.p.m. of streptomycin any of these was effective. Pure streptomycin sulfate sprays were less effective in controlling the disease than the streptomycin formulation sprays. An Agrimycin 500 spray containing 25 p.p.m. of streptomycin and 25 p.p.m. of neutral copper gave considerably better protection against downy mildew than did Copper A or Agrimycin 100, each at 25 p.p.m. The action in the control of downy mildew was synergistic. A streptomycin dust containing 1000 p.p.m. of streptomycin gave the same protection as sprays at 100 p.p.m.

Lima bean plants can be protected from downy mildew, caused by Phytophthora phaseoli Thaxt., with streptomycin, as briefly reported by Zaumeyer and Wester (4). The results of the greenhouse experiments, described in detail herein, suggest that this antibiotic is promising for reducing the heavy losses that this disease causes in some seasons to the lima bean crop along the Atlantic seaboard.

Materials and Methods

The materials studied were several commercial streptomycin formulations (Agri-mycin 100, Agri-mycin 500, Agristrep, and Phytomycin) and pure streptomycin sulfate in comparison with copper A. A formulated streptomycin dust was also tested. Tween 20 (0.1%) was used as the wetting agent in the pure streptomycin sprays. The commercial formulations contained wetting agents of unknown compositions.

Early Thorogreen lima bean was the test host. The seeds were germinated in sand in the greenhouse maintained at a temperature of 75° to 80°F. When the plumules of the germinating seeds were visible, about 4 days after planting, the germinated seeds were transplanted to sand in 5-oz. paper cups, one seedling per cup. Uniform-size seedlings were selected for treatment when they were about 4 to 6 inches tall and their primary leaves were about 2 inches in width, or about three-fourths final size.

The sprays were thoroughly applied to the seedling with a small DeVilbiss atomizer at a pressure of about 20 pounds. Then the treated plants were placed in an open greenhouse for about 24 hours before inoculation. The plants treated with the streptomycin dust formulation or Copper A dust were sprayed first with a fine mist of water and immediately dusted. These plants also were kept in the open greenhouse for 24 hours prior to inoculation.

Inoculum was prepared by stirring downy-mildew-infected petioles and stems of inoculated plants on which the fungus was sporulating abundantly in a small amount of water to remove the conidia. The spore suspension was sprayed on the upper surfaces of the primary leaves and on the terminal buds of the treated plants. Comparable inoculated but untreated plants served as controls. After inoculation, the plants were immediately placed for 48 hours in a fog chamber in which saturated humidity was maintained. Then they were removed from the chamber and kept in subdued light for 24 to 36 hours before placement under ordinary greenhouse conditions. About 10 days after inoculation the results were recorded.

Results

Under the conditions of the experiments herein reported, Agri-mycin 100, Agristrep (Fig. 2, A), and Phytomycin (Fig. 1, B), sprays containing 100 p.p.m. of streptomycin almost completely protected lima beans from downy mildew infection (Table 1). At 500 p.p.m. of streptomycin, protection was no better (Table 1).

---

[1] Respectively, Pathologist and Horticulturist, Horticultural Crops Research Branch, Agricultural Research Service, United States Department of Agriculture, Beltsville, Maryland

Table 1. Comparative protection of Early Thorogreen lima beans from downy mildew with pure streptomycin, commercial streptomycin formulations, and copper.

Material	Concentration of active ingredients p.p.m.	Tests Number	Plants tested Number	Disease index [a]
Agri-mycin 100 [b]	500	1	50	3.8
Agristrep [c]	500	1	50	3.4
Phytomycin [d]	500	-	-	-
Pure streptomycin sulfate	500	1	50	2.8
Copper A	2000	1	50	3.7
None	-	1	50	0.1
Agri-mycin 100	100	3	70	3.7
Agristrep	100	2	50	3.8
Phytomycin	100	2	50	3.4
Pure streptomycin sulfate	100	2	45	3.0
None	-	3	70	0.3
Agri-mycin 100	50	4	90	3.5
Agristrep	50	2	45	1.8
Phytomycin	50	2	45	3.3
Pure streptomycin sulfate	50	2	45	1.5
Copper A	2000	3	70	3.9
None	-	6	135	0.6

[a] 4, complete protection; 0, very severe infection.
[b] Contains 15% streptomycin sulfate and 1.5% oxytetracycline (Terramycin).
[c] Contains 37% streptomycin sulfate.
[d] Contains 20% streptomycin nitrate.

Table 2. Comparative protection of lima beans from downy mildew with two streptomycin formulations and neutral copper.

Material	Concentration of active ingredients p.p.m.	Tests Number	Plants tested Number	Disease index [a]
Agri-mycin 100	50	3	55	3.2
Agri-mycin 500 [b]	50	3	55	3.8
Copper A	50	2	35	1.5
None	-	3	55	0.7
Agri-mycin 100	25	1	10	1.3
Agri-mycin 500 [b]	25	1	10	3.5
Copper A	25	1	10	0.3
None	-	1	10	0.7

[a] 4, complete protection; 0, very severe infection.
[b] Contains 10% streptomycin, 1% oxytetracycline (Terramycin), and 10% metallic copper.

FIGURE 1. Protection of lima beans from downy mildew by (A) Agri-mycin 500 spray (50 p.p.m. streptomycin plus 50 p.p.m. copper) and (B) Phytomycin spray (100 p.p.m. streptomycin). Untreated check at right in each case.

When the concentration of streptomycin was reduced to 50 p.p.m., the lower limit of control, differences were observed. Plants sprayed with Agri-mycin 100 (Fig. 3, right) or Phytomycin had less mildew than those sprayed with Agristrep (Table 1). The reason for this difference is not known, but possibly some differences in formulation might be responsible.

A spray containing 100 p.p.m. of pure streptomycin sulfate was less effective in protecting plants from infection than sprays of any of the formulated compounds at the same concentration of streptomycin. In fact, Agri-mycin 100 and Phytomycin when used at 50 p.p.m. of streptomycin were more effective than pure streptomycin used at 100 p.p.m. A spray of pure streptomycin at 50 p.p.m. (Fig. 3, left) was ineffective (Table 1). Although Tween 20 was used as the wetting agent with the pure streptomycin sprays, possibly the commercial products were better formulated, and therefore better control of the fungus resulted. It is doubtful that some minor fraction with fungicidal properties in the formulated products, but not in the pure streptomycin, accounted for the differences.

Copper A. at about 2000 p.p.m. of metallic copper protected lima beans from downy mildew infection to the same degree as streptomycin at 100 p.p.m. (Table 1). In other tests it gave excellent protection at 1250 p.p.m.

Even though streptomycin has been shown to be absorbed by stems and leaves of bean and translocated in the plants (3), thoroughness in application of the spray to the plants is essential for satisfactory protection against the downy mildew fungus. This was demonstrated in a preliminary experiment where the leaves, stems, and growing points of lima bean seedlings were thoroughly sprayed with a 100 p.p.m. streptomycin solution, later inoculated with the downy mildew fungus, and compared with similar seedlings not so thoroughly sprayed. The disease index of the thoroughly sprayed seedlings was 3.7 (an index of 4 indicates complete protection),

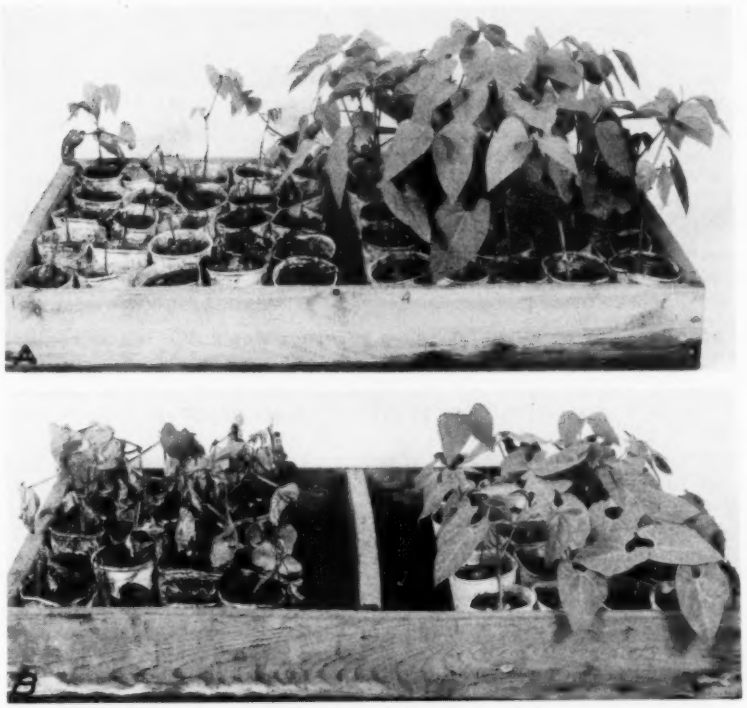


FIGURE 2. Protection of lima beans from downy mildew by (A) Agristrep spray (100 p.p.m. streptomycin) and (B) streptomycin dust (1000 p.p.m. streptomycin). Untreated check at left in each case.

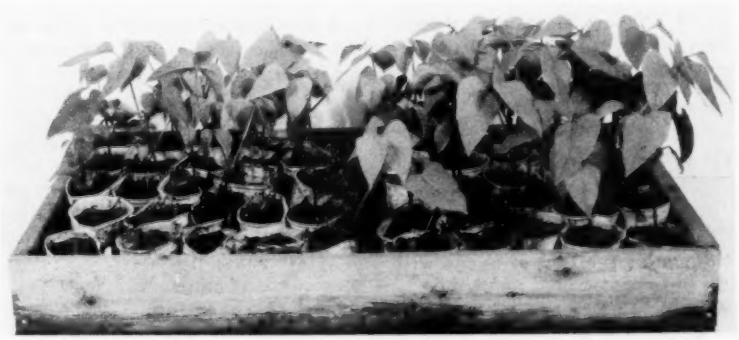


FIGURE 3. Protection of lima beans from downy mildew by (left) 50 p.p.m. pure streptomycin spray and (right) Agri-mycin 100 spray (50 p.p.m. streptomycin).

Table 3. Comparative protection of lima beans from downy mildew with streptomycin dust formulations and copper dust.

Dust formulation	Concentration	Plants tested Number	Disease index [a]
Streptomycin	1000 p.p.m.	20	3.8
Streptomycin	500 p.p.m.	20	.0
Copper A	10%	20	3.8

[a] 4, complete protection; 0, very severe infection.

while the index of the seedlings having a less thorough coverage was 3.3. The untreated plants had an index rating of 1.

An Agri-mycin 500 spray containing 50 p.p.m. of streptomycin and an equal amount of neutral copper (Fig. 1, A) gave considerably better protection against downy mildew than Copper A alone at 50 p.p.m. and slightly better than Agri-mycin 100 at 50 p.p.m. of streptomycin (Table 2). When the concentrations of streptomycin and copper were each reduced to 25 p.p.m., the combination gave considerably better protection than either compound alone (Table 2). Plants treated with Agri-mycin 500 had a disease index of 3.5 while those treated with Agri-mycin 100 and copper had an index of 1.3 and 0.3, respectively.

The data presented thus indicate that the action involved in Agri-mycin 500 at the 25 p.p.m. concentration each of streptomycin and neutral copper was synergistic in reducing downy mildew infection. Agri-mycin 500 when used at 50 p.p.m. of streptomycin and the same concentration of neutral copper seemed to have an additive effect but not true synergism. Cox (1) in his studies on the control of bacterial blight of celery, caused by Pseudomonas apii Jagger, with Agri-mycin plus Copper A found the same additive effect.

Gray (2) reported that in greenhouse tests the addition of glycerine to streptomycin sprays caused a marked increase in effectiveness against Xanthomonas phaseoli (E. F. Sm.) Dowson in beans. He reported that a spray containing 50 p.p.m. of streptomycin sulfate plus 1% glycerine was more effective than one containing 200 p.p.m. of streptomycin alone. The increase in effectiveness against the disease caused by glycerine was correlated with an increase in absorption of streptomycin by the leaves. This was not found true in the control of downy mildew. Sprays containing 50 or 100 p.p.m. of streptomycin plus 1% glycerine were no more effective than those containing streptomycin alone, either in the sulfate or nitrate form, or than streptomycin in combination with Terramycin.

A streptomycin dust containing 1000 p.p.m. of streptomycin afforded the same protection as streptomycin sprays at 100 p.p.m. of streptomycin. A dust containing 500 p.p.m. of streptomycin was ineffective (Table 3). For the dust to be effective, however, it is necessary that the plants be wet so that they will absorb the streptomycin.

Literature Cited

1. Cox, R. S. 1955. Compatibility between streptomycin-Terramycin formulation and copper in the control of bacterial blight of celery. Plant Dis. Reptr. 39: 484-486.
2. Gray, R. A. 1955. Increasing the effectiveness of streptomycin against the common blight of beans with glycerin. Plant Dis. Reptr. 39: 567-568.
3. Mitchell, J. W., W. J. Zaumeyer, and W. H. Preston. 1954. Absorption and translocation of streptomycin by bean plants and its effect on the halo and common blight organisms. Phytopathology 44: 25-30.
4. Zaumeyer, W. J., and R. E. Wester. 1956. Control of downy mildew of lima beans with streptomycin. (Abstract). Phytopathology 46: 32.

AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MARYLAND

CONTROL OF THE EARLY MATURITY DISEASE OF POTATOES BY SOIL TREATMENT WITH VAPAM[1]

Roy A. Young

Abstract

The early maturity disease of potatoes was effectively controlled by application of 190 pounds of Vapam per acre to the soil 10 days prior to planting. Vapam was applied at a depth of approximately 6 inches with a blade applicator. PCNB at the rate of 100 pounds per acre was ineffective. Both Vapam and PCNB markedly reduced the incidence of weeds. In untreated soil, seed-piece treatment with dichlone or Semesan Bel resulted in significant increases in yield as compared with the untreated check.

The early maturity or early dying disease of potatoes attributed principally to Verticillium albo-atrum has been reviewed recently by Nielsen (2). Affected plants turn yellow, cease growing and die before tubers reach marketable size. The time of appearance of symtoms and the severity of disease are dependent upon summer temperatures. However, in south central Oregon symptoms usually appear soon after August 1 or within 8 to 10 weeks after emergence of sprouts. In some soils that have been used for potato culture for many years the disease may occur in large areas in a field or an entire field of potatoes may be affected. Control of the disease has been difficult since neither suitable resistant varieties nor effective chemicals that could be used economically have been available.

The trials reported in this paper were conducted to determine whether or not the early maturity disease could be controlled by treatment of infested soil with certain fungicidal chemicals or by combinations of soil and seed-piece treatment. Vapam (sodium N-methyl dithiocarbamate dihydrate) was selected because preliminary trials showed it to be an excellent fungicide. PCNB (pentachloronitrobenzene) was used because of its long residual effect although it has been relatively ineffective against Verticillium and Fusarium species. Since earlier trials showed that pre-planting dip treatments of cut seed pieces in dichlone (1 pound in 10 gallons) or Semesan Bel (1 pound in 10 gallons) resulted in significant decreases in the incidence of wilt (4), various seed piece treatments were included in the trial.

METHODS

A section of an infested field, 200 by 600 feet, was divided into twelve strips 200 by 50 feet. Each of the following materials was applied to three randomly selected strips: Vapam 190 pounds per acre, PCNB 100 pounds per acre, or Vapam and PCNB. Three strips were left untreated. Prior to treatment the soil was plowed, disced and packed. PCNB (75% wettable) was mixed with two parts of gypsum, applied to the soil surface with a fertilizer spreader and then double-disced into the soil. Vapam was injected into the soil to a depth of approximately 6 inches, using a blade injector designed and built by Jensen and Page (1, 3). The soil was packed with a roller culti-packer immediately after treatment. The plot was disced 5 days after treatment and planted with Russet Burbank seed potatoes 10 days after treatment.

At the time of planting the plot area was divided into three replicate strips approximately 60 by 600, and four rows of each of the following treatment combinations were planted in each replication:

---

[1]Technical Paper No. 998, Oregon Agricultural Experiment Station.

The cooperation of Clarence Hill, Klamath Falls, Oregon, in furnishing land for an experimental plot, of Dr. H. J. Jensen and G. E. Page in applying Vapam and of A. E. Gross, Superintendent, Klamath Experimental Area in certain phases of the plot work is gratefully acknowledged.

1. No treatment
2. Fertilizer 100 N, 50 P, 50 K
3. Fertilizer, plus treatment of cut seed pieces in dichlone (1 pound-10 gallons)
4. Fertilizer, plus treatment of cut seed pieces in Semesan Bel (1 pound - 10 gallons)
5. Fertilizer, plus treatment of cut seed pieces in Semesan Bel (1 pound - 10 gallons), plus heptachlor (2 pounds - 100 gallons)

Fertilizer was side-dressed at the time of planting and at the last cultivation. Seed-piece treatments consisted of a one-minute dip of freshly cut seed in the fungicides or mixtures indicated. Plots were treated on May 9, planted on May 19, and harvested on September 29. Observations were made on emergence, stand, incidence of weeds, and disease control as indicated by top symptoms and yield.

Vapam was supplied by the Stauffer Chemical Company and pentachloronitrobenzene by Olin Mathieson Chemical Corporation.

RESULTS

Emergence and Stand

Emergence was delayed in plots treated with PCNB but within 3 to 4 weeks after emergence differences could not be observed except in plots treated with PCNB alone. In this experimental planting seed-piece decay was not prevalent, and there were no significant differences in stand as a result of either seed or soil treatments.

Incidence of Weeds

Counts made of the incidence of various weeds in the soil treatment plots on August 3 are shown in Table 1.

Table 1. Effect of soil treatment on incidence of various weeds.

Treatment	Total number of weeds in 6 20-foot sections of row				
	Pigweed	Lambsquarter	Mallow	Filaree	Grasses
Vapam	2	1	51	59	3
PCNB	0	0	17	22	5
Vapam and PCNB	0	0	12	16	2
Untreated	29	14	40	128	33

Both Vapam and PCNB showed marked herbicidal activity but PCNB was more effective than Vapam. Pigweed and lambsquarter were eradicated completely by PCNB and the incidence of mallow, filaree, and grasses was reduced markedly as compared to the untreated check. Vapam was most effective against pigweed, lambsquarter, and the grasses.

Disease Control

Significant disease control was obtained by both seed treatment and soil treatment. The most striking effects resulted from soil treatment with Vapam as may be seen in Figure 1, an aerial photograph of the entire plot. Plants growing in soil treated with Vapam remained green long after plants in the untreated soil and PCNB-treated soil had become yellow and dry The light streaks running lengthwise of the plot are the untreated strips that did not receive a side dressing of fertilizer.

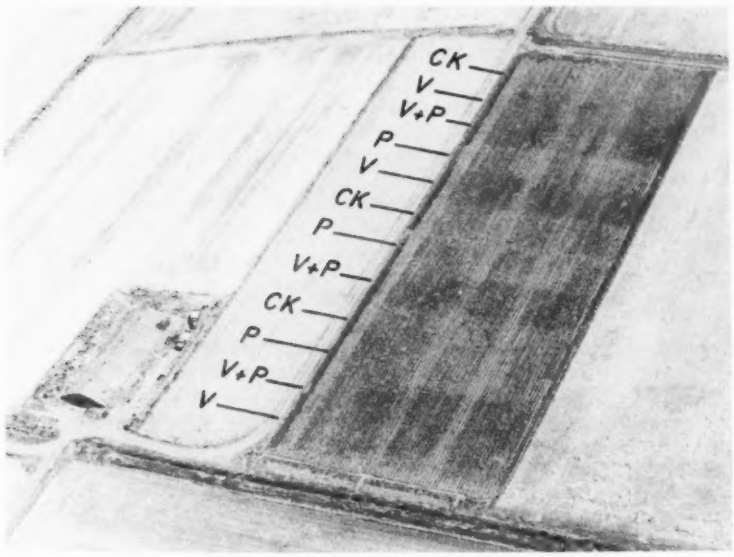


FIGURE 1. Aerial photograph of experimental plot. Light areas indicate dead or yellow plants, dark areas green plants. Three light streaks running lengthwise of plot are no fertilizer treatment. Letters designate soil treatments as follows CK = untreated check, V = Vapam, V + P = Vapam + PCNB, P = PCNB. Photographed by Stinson's Flying Service, Klamath Falls, Oregon.

Table 2. The effectiveness of fertilizer, seed treatment, and soil treatment in controlling the early maturity disease of potatoes, as indicated by yield.

Treatment at planting	Total yield from 18 30-foot sections of row in soil[a]			
	Untreated	Treated with PCNB	Treated with Vapam	Treated with Vapam + PCNB
No treatment	74.5	80.5	330.3	378.5
Fertilizer	152.0	257.5	607.0	629.0
Fertilizer + Dichlone Seed Treatment	261.5	343.5	626.2	613.5
Fertilizer + Semesan Bel Seed Treatment	210.3	317.2	601.1	614.0
Fertilizer + Semesan Bel and Heptachlor Seed Treatment	217.0	350.5	602.0	662.5

[a] Significance determined by sign test. Differences between unbracketed figures in each column significant. No significant differences between figures within brackets.

The effectiveness of Vapam in controlling the early maturity disease was also strikingly reflected in yield data (Table 2). Yields were approximately quadrupled in plots treated with Vapam as compared with no treatment and fertilizer alone and more than double the yields from fertilizer plus seed treatment.

In the untreated and PCNB treated plots, seed-piece treatment with dichlone or Semesan Bel resulted in significant increases in yield as compared with the fertilizer treatment; however, there were no significant differences between the fungicidal seed treatments or due to the addition of heptachlor to the mixture.

PCNB and fertilizer also significantly increased yields as compared with fertilizer alone although treatment with PCNB alone did not result in a significant increase over the untreated check.

DISCUSSION

Injection of 190 pounds of Vapam into the soil 10 days prior to planting resulted in striking control of the early maturity disease of potatoes attributed principally to Verticillium albo-atrum. Application of PCNB alone or in combination with Vapam had little effect. In view of other verbal reports of failure to control Verticillium-induced diseases with Vapam, it is suggested that the method of application is of great importance in obtaining satisfactory control. With the blade applicator used the Vapam was sprayed in a continuous layer approximately 6 inches deep in the soil, whereas the usual method of application has been to apply the Vapam in water to the surface of the soil and to rely on downward percolation to carry the Vapam into the soil.

At present prices these data do not represent economic control of Verticillium wilt of potatoes. However, the data are of interest because they demonstrate that Vapam can be used effectively as a soil fumigant to combat a soil-borne vascular fungus and because the method of application is adaptable to large scale operations. Considering the multiple benefits of disease control and weed control, similar use of Vapam on high acre-value crops would be very practical even at present levels of cost.

Literature Cited

1. Jensen, Harold J., and G. E. Page. 1954. An experimental blade-type soil fumigant applicator. Plant Dis. Reptr. 38: 401-402
2. Nielsen, L. W. 1948. Verticillium wilt of potatoes in Idaho. Univ. Idaho Agr. Exp. Sta. Res. Bul. 13. 23 pp.
3. Page, Glen, and Harold Jensen. 1956. Soil fumigation equipment for nematode control. Oregon Agr. Exp. Sta. Bul. 555. 19 pp.
4. Young, Roy A., and J. A. Milbrath. 1952. Prevention of potato seed-piece decay. Oregon Vegetable Digest 1: 9-11.

DEPARTMENT OF BOTANY AND PLANT PATHOLOGY, OREGON AGRICULTURAL EXPERIMENT STATION, CORVALLIS, OREGON

SEED-TREATMENT TESTS ON WINTER OATS AND WHEAT IN 1955-56

R. W. Leukel and R. W. Earhart [1]

In the fall of 1955 seed samples of Fultex oats were treated at Beltsville, Maryland, each with one of 18 fungicides. The seed was naturally infected with loose smut (Ustilage avenae (Pers.)Rostr.) and to some extent with covered smut (U. kolleri Wille).

The seed samples (500 cc) were placed in glass quart jars, and the chemicals, either as liquids or slurries, accurately measured with a pipette, were evenly applied to the inside walls of the jars. The jars were then shaken until the sides were clear and the fungicides were evenly distributed on the seeds.

The composition of the different fungicides and the names of the firms supplying them are listed below:

Manufacturers, Fungicides and Ingredients		Percent Ingredient	Percent Mercury
E. I. Dupont de Nemours and Company			
Ceresan M	ethyl Hg P-toluene sulfonanilide	7.7	3.2
Ceresan M 2X	ethyl Hg P-toluene sulfonanilide	15.4	6.5
Ceresan 244	phenyl Hg acetate	2.27	2.44
	ethyl Hg acetate	1.57	
Ceresan 365	phenyl Hg acetate	3.39	3.65
	ethyl Hg acetate	2.35	
Ceresan D (now Ceresan 75)			
	ethyl Hg 2-3, dihydroxy propyl mercaptide	2.8	2.1
	ethyl Hg acetate	0.6	
Ceresan S (now Ceresan 200)			
	ethyl Hg 2-3, dihydroxy propyl mercaptide	6.0	4.5
	ethyl Hg acetate	1.3	
Gallowhur Chemical Corporation			
Puraseed	N-phenyl mercuriformamide	6.25	3.85
	anilino cadmium lactate	6.25	
Chipman Chemical Corporation			
Agrox	phenyl Hg urea	6.7	4.0
MEMA	methoxy ethyl Hg acetate	11.4	7.17
Y.F.-2576	methoxy ethyl Hg acetate	23.85	15.0
Panogen Inc.			
Panogen 15	methyl mercury dicyandiamide	2.1	1.5
Panogen 45	methyl mercury dicyandiamide	6.3	4.2
PA-2N	methyl mercury dicyandiamide	0.4	0.25
	aldrin	24.4	
H. L. Woudhuysen and Associates			
Merculine	phenyl Hg salicylate	10.0	4.7
Metal Salts Corporation			
Metasan M	methyl Hg oxyquinolinate	5.7	3.2
Metasol M	methyl Hg oxyquinolinate	2.7	1.5
Metasan E	ethyl Hg oxyquinolinate	6.0	3.2
Metasol E	ethyl Hg oxyquinolinate	3.7	2.0
W. A. Cleary Corporation			
Setrete (sold also as: Cytrete, Gallotox and Pentrete by other concerns)	phenyl Hg ammonium lactate	7.0	4.0

[1] Pathologist, Field Crops Research Branch Agricultural Research Service, United States Department of Agriculture, and Pathologist, Clemson Agricultural College, Clemson, South Carolina.

Table 1. Effect of seed treatments on emergence and smut control in Fultex oats in plots at Beltsville, Md. and Clemson, S. C., and on field stands at Clemson, 1955-56.

No.	Seed Treatment: Fungicide	Form	oz/bu	Greenhouse Emergence at: Beltsville	Clemson	Field data: Belts. Infec.	Clemson Infec.	Clemson Stand
				%	%	%	%	No.
1	Check	-	-	87	92.0	14.0	12.0	350
2	Ceresan M.	Slurry	0.5	90	94.0	0	0.3	279
3	Puraseed	"	0.5	87	87.5	1.1	2.2	225
4	Agrox	"	0.5	84	80.5	1.0	1.1	261
5	MEMA	liquid	0.25	88	90.5	0	0	288
6	Panogen	"	0.75	85	86.5	0	0	276
7	Merculine	"	0.5	80	83.0	6.0	1.4	277
8	Ceresan 244	"	0.75	81	86.5	0	0	276
9	Ceresan 365	"	0.5	81	85.5	0	0	272
10	Ceresan D	"	0.75	86	94.0	0	0	299
11	Check	-	-	87	92	16.0	18.2	341
12	Ceresan S.	liquid	0.25	83	87.5	0	0	279
13	Metasol M.	"	0.75	85	93.5	0	0	298
14	Metasol E.	"	0.75	83	87.5	0	0	279
15	Setrete	"	0.5	85	91.0	0	0.3	298
16	Metasan M.	Slurry	0.5	80	84.0	0	0	268
17	Metasan E.	"	0.5	82	85.0	0	0	271
18	YF-2576	liquid	0.15	90	91.0	0	0	290
19	Ceresan M-2X	slurry	0.25	93	97.0	0	0	309
20	Panogen PA2N	liquid	4.00	75	80.0	0	0	255

The treated seed was sown in replicated rows in outdoor beds at Beltsville, Md., and Clemson, S. C. The effect of the fungicides on emergence was studied by making replicated greenhouse plantings at both stations. Stand counts in the field were made at Clemson. These results are set forth in Table 1.

None of the fungicides seemed to improve emergence or stand significantly. Panogen PA2N reduced emergence somewhat at both stations and Agrox had a similar effect at Clemson. Only three materials at Beltsville and five at Clemson failed to eliminate smut completely. Merculine-treated seed produced 6 percent smut at Beltsville and 1.4 percent at Clemson. Four other materials failed to eliminate small percentages of smut at Clemson.

Samples of Purplestraw wheat artificially infested with spores of bunt, Tilletia caries (D.C.) Tul. and T. foetida (Wallr.) Liro, were similarly treated with the same fungicides applied to oats, and greenhouse and field plantings were made as described for oats. Infection in the checks at Beltsville was very light due to heavy rains and consequent wet soil after planting, followed

Table 2. Emergence, stand, and control of bunt in Purplestraw wheat, grown from infested seed, treated as shown and sown in replicated rows in field plots at Beltsville, Maryland, and at Clemson, South Carolina, 1955-56.

Seed treatment				Head counts in field at Beltsville		Head counts in field at Clemson		Greenhouse germination at	
No.	Fungicide	Form	oz/ bu	Total No.	Smutted %	Total No.	Smutted %	Belts. %	Clemson %
1	Untreated check	-	-	665	25.6	660	52.6	76	77
2	Ceresan M	slurry	1/2	690	0	648	0.1	85	87
3	Puraseed	"	1/2	695	0	660	0.4	80	81
4	Agrox	"	1/2	620	0	648	0	70	77
5	MEMA	liquid	1/4	630	0	632	0	82	84
6	Panogen	"	3/4	610	0	656	0	90	88
7	Merculine	"	1/4	575	0	652	0	84	80
8	Ceresan 244	"	3/4	585	0	652	0	83	85
9	Ceresan 365	"	1/2	545	0	656	0	85	86
10	Ceresan D	"	3/4	550	0	632	0	87	88
11	Untreated check	-	-	570	29.1	628	50.4	72	77
12	Ceresan S	liquid	1/4	555	0	692	0.1	86	89
13	Metasol M	"	3/4	580	0	652	0.3	86	88
14	Metasol E	"	3/4	570	0	676	0.1	85	84
15	Setrete	"	1/2	575	0	628	0.3	87	84
16	Metasan M	slurry	1/2	535	0	628	0	78	74
17	Metasan E	"	1/2	530	0	720	0.3	83	85
18	Chipman YF	liquid	1/8	615	0	684	0	84	82
19	Ceresan M2X	slurry	1/4	590	0	724	0	80	78
20	Panogen PA2N	liquid	4	610	0	724	0.1	82	85

by soil temperatures too high to favor infection (Table 2). More favorable conditions after planting at Clemson resulted in a much higher percentage (51.5 percent) of bunt-infected heads in the checks. Ten of the fungicides completely eliminated bunt infection at Clemson while the remaining eight reduced it to 0.4 percent or less.

At Beltsville all of the fungicides eliminated bunt.

UNITED STATES AGRICULTURAL RESEARCH SERVICE AND CLEMSON AGRICULTURAL COLLEGE, CLEMSON, SOUTH CARLOINA

FIELD CONTROL OF GREY MOLD OF STRAWBERRIES

P. M. Miller and E. M. Stoddard

Summary

In field trials, three applications of thiram, dichlone, or captan, starting at bloom and spaced 10 to 14 days apart, reduced the number of berries infected by grey mold. Thiram and dichlone reduced the number of infected berries to less than one third that of the control, while captan plots had two thirds as many infected berries as the control. Phygon XL (dichlone) and Thylate (thiram) gave about equal control, and both possess long residual actions since one gathering of fruit was made 19 days after the last spray application.

Grey mold of strawberries, caused by Botrytis cinerea Pers. ex Fr., has long been a difficult disease to control. Powell (5, 6) in Illinois and Horn (1) in Louisiana reported good control with captan. However, in trials by growers and others in Connecticut captan has failed to give satisfactory results. Marsh and coworkers (2, 3, 4) reported thiram to give good control in both greenhouse and field trials in England. Stoddard and Miller (7) reported that thiram and dichlone as well as some experimental materials gave better control than captan in greenhouse trials. Therefore, it seemed advisable to compare commercial formulations of captan, thiram and dichlone under field conditions.

EXPERIMENTAL

The commercially-formulated materials tested were Captan 50-W, containing 50% captan and applied at the rate of 6 pounds in 100 gallons; Phygon XL, containing 50% dichlone and applied at 3/8 pound in 100 gallons; and Thylate, containing 50% thiram and applied at 3 pounds in 100 gallons. The plots were sprayed by the grower in whose field the trials were made. Applications were made on May 18, June 4, and June 14, using a sprayer with a 16 gpm pump carrying 400-600 psi pressure. The spray was put on with a hand gun which made very thorough coverage possible. The long interval between applications was tried because the greenhouse trials indicated that both dichlone and thiram possessed long residual capacity. The first application was made about the start of bloom and the last 13 days before picking. Each treatment was replicated three times on 75-foot rows of Robinson strawberries.

Two counts of infected fruit were made, on June 27 and July 3. Counts were made by removing for count all infected fruit from 5 sections of the row, then moving 10 feet further down the row and taking another 5-foot section. Five such sections were counted in each replicate, thus making a total of 15 for each treatment. Both counts were made in the same 5-foot sections, so that the number of new infections occurring between counts could be determined.

RESULTS AND DISCUSSION

The results are given in Table 1. The total number of infected berries obtained from all sections counted in the three replicates of each treatment are given on each picking date. The number of infected fruit is also expressed as a percentage of the number found in the unsprayed control, which is considered as 100 percent. Phygon XL and Thylate gave approximately equal control. This was double that given by Captan 50-W.

The fact that plots treated with Phygon XL and Thylate on June 14 still had less than one third as many infected fruits as the control 19 days after spraying points to a long residual protection by these materials. Thus a spray applied 5 to 7 days before the start of harvest should carry through most of the picking season. The 10 to 14 days between sprays appears to be short enough to maintain adequate protection. Since many of the strawberry growers of Connecticut are also vegetable growers, they are very busy with other duties during the usual strawberry spraying season. The time gained by spraying every 10 to 14 days as against the 5 to 7 days recommended for materials currently being used could be used very advantageously by them during this busy season.

Table 1. Control by fungicides of grey mold of strawberries

Fungicide and concentration (lbs/100 gal.)[a]	Infected berries on indicated date of count			
	June 27		July 3	
	Number[b]	Percent as compared with control plots	Number	Percent as compared with control plots
Captan (6 lbs.)	372	71	526	65
Thylate (3 lbs.)	167	31	219	27
Phygon (3/8 lb.)	145	28	261	32
Unsprayed control	528	100	812	100
L S D 5 percent = 16			28	

[a]Fungicides were applied on May 18, June 4 and June 14. First application was made just at start of bloom.

[b]Total number of infected berries from 15 five-foot sections, 5 from each of 3 replicates.

Literature Cited

1. Horn, Norman L. 1952. Strawberry fungicide screening tests. Plant Dis. Reptr. 36: 309-310.
2. Kirby, A. H. M., M. H. Moore, and Dorothy J. Wilson. 1955. Strawberry Botrytis rot (grey mould) control: a field trial of captan at East Malling. Jour. Hort. Sci. 30: 220-224.
3. Marsh, R. W., J. T. Martin, and Alice Crang. 1955. The control of Botrytis rot (grey mould) of strawberries and effects of fungicide spray residues on the processed fruit. Jour. Hort. Sci. 30: 225-233.
4. Moore, M. H., and R. P. Tew. 1955. Greenhouse testing of fungicides against Botrytis rot (grey mould) of strawberry and other soft fruits. Jour. Hort. Sci. 30: 213-219.
5. Powell, Dwight. 1952. The effect of early spring fungicides on Botrytis cinerea. Plant Dis. Reptr. 36: 97-98.
6. Powell, Dwight. 1954. The effect of captan on gray mold incidence and yield of strawberry. Plant Dis. Reptr. 38: 209-212.
7. Stoddard, E. M., and P. M. Miller. 1956. Control of grey mold on strawberries under greenhouse conditions. Plant Dis. Reptr. 40: 443-445.

DEPARTMENT OF PLANT PATHOLOGY & BOTANY
THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONNECTICUT

THE RELATION OF NEMATODES TO STRAWBERRY CULTURE IN LOUISIANA

N. L. Horn, W. J. Martin, W. F. Wilson, Jr., and M. J. Giamalva[1]

Summary

A survey of the soil-borne nematodes of the commercial strawberry growing areas of Louisiana showed that 25 genera of nematodes were found in soil around strawberry roots. Of these, seven genera were known to be plant parasites, and three were suspected plant parasites. The frequency of the occurrence of certain of the parasitic forms was determined.

Greenhouse experiments showed that Tylenchorhynchus claytoni and Meloidogyne hapla propagated readily on roots of the Klonmore variety growing in steamed-sterilized soil, with severe root damage resulting from M. hapla only.

Field soils known to harbor parasitic forms were treated with ethylene dibromide. High populations of the various parasitic forms were greatly reduced by the treatment and the numbers remained low throughout the harvest period. Yields of plants in treated field soils were significantly higher than yields of plants in untreated soils only when M. hapla was controlled. Yields were not measurably affected by controlling Tylenchorhynchus sp., Pratylenchus sp., and Trichodorus sp.

INTRODUCTION

Since 1948 observations in Louisiana strawberry fields have revealed various cases of unthrifty plant growth which could not be attributed to the commonly known diseases. Since root-knot nematodes were present in the problem areas, investigations were started to determine the role of soil-borne nematodes in causing this condition. Different workers have reported on nematode damage to strawberry plants. Campbell (2) observed that root-knot nematodes severely damaged or even killed strawberry plants when present in high populations. Chitwood (3) indicated that Meloidogyne hapla Chitwood, 1949, was the only root-knot nematode to reproduce on strawberry plants. Later Sasser (12) confirmed this. More recently Goheen and McGrew (6) pointed out that M. hapla was especially damaging to strawberry roots during periods of summer drought. Nematodes other than those causing root-knot have been associated with root diseases of strawberry (1, 4, 7, 8, 9, 11).

This paper has the following objectives: 1) to record the plant parasitic nematodes which were found in Louisiana strawberry fields, 2) to give results of greenhouse tests to determine pathogenicity of some of the nematodes to strawberry, and 3) to show the results of soil fumigation experiments in relation to yield in soils infested with the different nematodes. A preliminary report of these results has been made (10).

NEMATODE SURVEY IN STRAWBERRY FIELDS

Soil samples were obtained from 40 strawberry fields in widely scattered parts of the commercial growing area. The nematodes were screened from the soil samples according to the method of Christie and Perry (5), and the genera and in some instances the species were determined in each sample. A summary of these data is given in Table 1. Two of the serious nematode pests of strawberry, Belonolaimus gracilis Steiner 1949, and Pratylenchus penetrans (Cobb) Sher & Allen 1953, were not found in the soils examined.

GREENHOUSE EXPERIMENTS

Test plants were obtained by layering visually clean runners in sterile soil in 4-inch clay

---

[1]Respectively, Assistant Plant Pathologist and Plant Pathologist, Louisiana State University, Agricultural Experiment Station, Baton Rouge, Louisiana, and Superintendent and Assistant Horticulturist, Fruit and Truck Experiment Station, Hammond, Louisiana. The authors are indebted to Max J. Fielding for identification of the nematodes and to John P. Hollis for assistance in collection of the nematodes during field surveys.

Table 1. Nematodes associated with strawberry roots in Louisiana.

Parasitic nematodes	Frequency in samples (percent)	Suspected parasites	Others, including predators, saprophytes, and free-living forms
Aphlenchoides besseyi Christie 1942	10	Pungentus angulosos Thorne 1939	Acrobeles elaboratus Thorne 1925
Aphlenchoides spp.		Pungentus sp.	Acrobeles sp.
Criconemoides sp.	5		Alaimus sp.
Ditylenchus sp.	1	Tylenchus spp.	Aphelenchus avenae Bastian 1865
Helicotylenchus nannus Steiner 1945	47	Xiphinema americanum (Cobb 1913)	Cephalobus spp.
Helicotylenchus spp.			Chiloplacus sp.
Meloidogyne hapla Chitwood 1949	42		Diplogaster sp.
Meloidogyne spp.[a]			Discolaimus sp.
Pratylenchus leiocephalus Steiner 1949	10		Dorylaimus spp.
Pratylenchus sp.			Eucephalobus sp.
Trichodorus spp.			Mononchus spp.
Tylenchorhynchus claytoni Steiner 1937	58		Panagrolaimus subelongatus (Cobb 1914) Thorne 1937
Tylenchorhynchus sp.			Psilenchus spp.
			Rhabditis spp.
			Seinura sp.

[a]Only males and larvae were observed.

Table 2. The mean[a] number of nematodes of Meloidogyne hapla and Tylenchorynchus sp. added to the soil of pots planted with strawberry plants and the number of nematodes per pot[b] 190 days later.

	Numbers added		Numbers per pot 190 days later	
Treatment	M. hapla	Tylenchorhynchus sp.	M. hapla	Tylenchorhynchus sp.
I	0	0	0	0
II	0	500	0	2,560
III	462	362	22,420	8,400

[a]Means of 4 pots except in treatment II where only 1 pot was used.

[b]Estimated on the basis of the number of nematodes obtained in pint soil sample from each pot. Larvae, only, of M. hapla were counted

pots in the greenhouse. These new plants were separated from the mother plant and set aside on a clean bench. When the test plants became well rooted, they were transferred to 8-inch pots containing sterilized soil to which were added water suspensions of Tylenchorhynchus sp. plus Meloidogyne hapla (larvae) and Tylenchorhynchus sp. alone. Untreated plants grown in similar sterilized soil to which no nematodes were added were used as the controls. Approximately 190 days later, a pint soil sample was taken from the soil in each pot and the nematodes counted (Table 2). The data indicated that both M. hapla and Tylenchorhynchus sp. multiplied rapidly under the conditions tested. However, most of the apparent damage to the roots was caused by the root-knot nematode. There was little injury to the roots of plants grown in soil infested with Tylenchorhynchus sp. alone. Plants grown in soil to which no nematodes were added were healthy in appearance.

A similar test including M. hapla in combination with Helicotylenchus sp. was made in the greenhouse. Again the differences between plants grown in infested soil and non-infested soil were obvious. The plants in non-infested soil were much more vigorous. Soil samples were taken from these pots, also, and the nematodes counted (Table 3).

Table 3. The mean[a] number of nematodes of Meloidogyne hapla and and Helicotylenchus sp. added to each pot planted with strawberry plants and the number of nematodes per pot[b] 165 days later.

	Numbers added		Numbers per pot 165 days later	
Treatment	M. hapla	Helicotylenchus sp.	M. hapla	Helicotylenchus sp.
I	0	0	0	0
II	1,289	790	18,320	360

[a]Means of 4 replicates.

[b]Estimated on the basis of the number of nematodes obtained in a pint soil sample from each pot. Larvae, only, of M. hapla were counted.

FIELD EXPERIMENTS

Soil fumigation tests using ethylene dibromide were made over a period of 2 years in commercial fields and at the Louisiana State University Experiment Station, Baton Rouge, Louisiana. During 1954, three tests were made in commercial fields and one test at the Experiment Station in Baton Rouge. The soils at location I were heavily infested with Tylenchorhynchus sp. and Pratylenchus spp., at location II with Helicotylenchus spp. and Tylenchorhynchus spp., at location III with Tylenchorhynchus spp., and at location IV with Meloidogyne hapla, Tylenchorhynchus sp., and Helicotylenchus sp. During 1955 only one location was used in the commercial area. This soil contained large populations of M. hapla. The same location was used in 1955 as in 1954 at the Experiment Station at Baton Rouge. However, the soil was nearly free of the organism in 1955 when the tests were started.

The 1954 Tests

The nematocide was applied at locations II and III with a special tractor-drawn pressure applicator which deposited the liquid at a depth of 8 inches. As the applicator passed through the soil a continuous stream of the liquid was deposited in the row only. The soil was in good condition for planting at the time of application, but was loosened by the injector blades. In order to maintain uniformity in soil tilth between treated and untreated plots, the machine was driven through the rows of the latter without releasing the nematocide. Applications were made on November 11, 1953, and Klonmore plants, obtained from cooperators at the respective locations, were set on December 1, 1953. Treatments consisted of 2 and 4 gallons of

Table 4. Mean[a] number of nematodes per pint of soil from the 1954 field test plots fumigated with Dowfume W-85.

Location	Rate	Mean No. Nematodes Per Pint of Soil			
		M. hapla[e]	Tylenchorhynchus sp.	Helicotylenchus sp.	Pratylenchus sp.
I[b]	4 gal./A	---	0	---	0
	Control	---	484.0	---	128.0
	L.S.D. 5%		349.0		50.9
	L.S.D. 1%		474.0		69.8
II[c]	2 gal./A.	---	0	12.5	---
	4 gal./A.	---	-	15.0	---
	Control		177.5	1132.5	---
	L.S.D. 5%		95.4	512.6	
	L.S.D. 1%		135.0	724.6	---
III[c]	2 gal./A.	---	2.0	---	---
	4 gal./A.	---	0	---	---
	Control	---	605.0	---	---
	L.S.D. 5%		379.9		
	L.S.D. 1%		537.0		
IV[d]	2 gal./A.	12.5	0	55.0	---
	4 gal./A.	7.5	0	2.5	---
	Control	62.5	45.0	230.0	---
	L.S.D. 5%	35.9	N. S.	N. S.	
	L.S.D. 1%	50.6			

[a] Mean of 4 replicates

[b] Soil samples taken 28 days after treatment.

[c] Soil samples taken 126 days after treatment.

[d] Soil samples taken 94 days after treatment

[e] Larvae counted.

Dowfume W-85 per acre, respectively, with non-fumigated plots for controls. Each treatment consisted of 1 row approximately 300 feet long. Plots were replicated 4 times at random. The plants were spaced about 1 foot apart on 40-inch rows. A pint soil sample was taken from each plot 126 days after treatment and nematodes counted. These data are given in Table 4. They indicate an effective control of the nematodes. Although yield data in crates per acre from locations II and III were obtained throughout the shipping season, there were no significant differences among the treatments.

The plots at locations I and IV were much smaller in size, containing 20 plants per plot, and each treatment was replicated 3 and 5 times, respectively. Applications were made with

Table 5. Mean[a] number of nematodes per pint soil sample from the 1955 strawberry nematocide test, 44 and 155 days after planting.

	Mean No. of Nematodes Per Pint of Soil							
	M. hapla[b]		Tylenchorhynchus sp.		Pratylenchus sp.		Helicotylenchus sp.	
	Days		Days		Days		Days	
Treatment	44	155	44	155	44	155	44	155
A	0	4	0	0	0	0	0	2
B	132	2922	252	732	4	0	93	154
C	0	6	0	0	0	0	0	0
D	232	1582	518	368	48	0	266	56
E	o	20	0	0	0	0	0	0
F	168	2514	330	702	6	0	96	30
G	0	2	0	0	0	0	0	0
H	196	1728	468	462	0	2	174	82
L.S.D. 5%	-	1183	262	375	-	-	157	-
L.S.D. 1%	-	1586	351	501	-	-	210	-

[a] Mean of 5 replicates

[b] Larvae of this species were counted.

a Maclean Fumigun to a depth of 6 inches on December 2, 1954. Injections were spaced about 1 foot apart using 2 and 4 gallons of Dowfume W-85 per acre. Soil samples were taken from all the plots at location I 28 days after application, and at location IV 94 days after treatment. The number of nematodes per pint of soil are given in Table 4.

No significant differences in yield were found in the test at location I. At location IV there was a significant difference in yields between the 2-gallon per acre rate and the controls, but not between the 4-gallon per acre rate and the controls. Possibly there was phytotoxicity at the higher rate. The yield in crates per acre of fruit harvested from Klonmore plants grown in non-treated soil at location IV was 187, in the treated soil at the 2-gallon rate 309 crates, and in the treated soil at the 4-gallon rate 236 crates. The L.S.D. at the 5% level was 77 crates and at the 1% level 112 crates.

The 1955 Tests

Because of the evidence that yields of strawberries were significantly lower in soils where Meloidogyne hapla was present, the 1955 field test was made at a location where this organism occurred in high populations. The test was arranged in a randomized block with 8 treatments and 5 replications as follows:

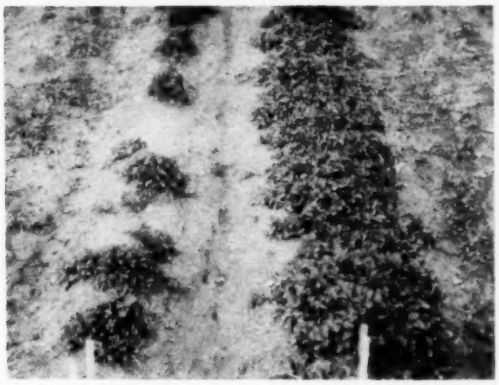


FIGURE 1. The soil in the bed on the right was treated with ethylene dibromide, whereas the soil in the bed on the left was not.

A -- Klonmore plants grown in methyl bromide-treated beds and transplanted in nematocide-treated soil.
B -- Klonmore plants grown in methyl bromide-treated beds and transplanted in untreated soil.
C -- Klonmore plants grown in untreated beds and transplanted in nematocide-treated soil.
D -- Klonmore plants grown in untreated beds and transplanted in untreated soil.
E -- Marion Bell plants grown in methyl bromide-treated beds and transplanted in untreated soil.
G -- L-27 plants grown in methyl bromide-treated beds and transplanted in nematocide-treated soil.
H -- L-27 plants grown in methyl bromide-treated beds and transplanted in untreated soil.

The soil in the fumigated test plots was treated with a Maclean Fumigun. Three gallons per acre of Dowfume W-85 were applied at the depth of 6 inches. Injections were made 1 foot apart in 2 lines on top of the rows, which were spaced 42 inches apart. Soil samples were taken 44 and 155 days, respectively, after planting (Table 5). Each plot contained 80 plants.

Yields in crates per acre were calculated for the early shipping season, the entire shipping season, and the total yield for the season. The data for yields in crates per acre are given in Table 6. Significant differences in yields of Klonmore plants were found between the following treatments: A and B, C and D, B and D, and C and D. Yields of L-27 plants were significantly higher in treated than in untreated soil. There was no significant difference in yield between the Marion Bell plants in the treated compared to the untreated soil.

Several plants from each plot were dug after the harvest season in June and the roots examined for root knot. Roots of plants from each untreated plot contained numerous galls, whereas the roots of plants from the treated plots had few to no galls. The remaining plants were cultivated and grown throughout the summer. During the hot weather many of the plants in the untreated plots died. By October 1955 the differences between plants in treated and untreated plots were obvious. The plants in the treated plots had produced much new growth, vegetation nearly covering the tops of the rows, but the untreated plots contained relatively few plants which had produced very little new growth (See Fig. 1).

Table 6. Mean yields in crates per acre for early shipping season, entire shipping season, and season total, in the 1955 strawberry-nematode test.

Treatment	Mean Yields in Crates Per Acre		
	Early	Entire	Season Total[a]
A	85.78	204.86	211.13
B	51.98	132.55	137.14
C	50.64	137.84	140.41
D	26.58	80.12	81.71
E	71.35	178.51	182.40
F	42.80	134.14	137,16
G	220.23	389.90	412.51
H	134.10	237.29	249.52
L.S.D. 5%	31.55	52.88	59.95
L.S.D. 1%	42.33	70.95	80.43

[a]Season total included berries that were harvested after the shipping season was closed.

DISCUSSION

In Louisiana strawberries are grown as annual plants set 10 to 14 inches apart and not in matted rows. In view of this fact the control of root knot should be much simpler than in other localities. However, no experimental work was done to determine the effectiveness of the treatment for more than 1 year.

In the 1955 tests the data indicated that the yield of the Marion Bell variety was not affected by root knot although numerous galls were found on the plants grown in untreated soils. No further tests were made to help explain this fact.

The yield of plants from the 4-gallon per acre treatment at location IV in the 1954 test was not significantly higher than yield of the controls, whereas the yield of plants from the 2-gallon per acre treatment was. Although there was no apparent difference in plant vigor between the plants grown in the soil treated at the 4-gallon rate and the control plants, the lack of yield increases in the 4-gallon per acre treatment may possibly have been due to an excess of nematocide.

Literature Cited

1. Brooks, A. N., and J. R. Christie. 1950. A nematode attacking strawberry roots. Proc. Florida State Hort. Soc. 1950: 123-125.
2. Campbell, L. 1948. Strawberry diseases in Washington. Washington Agr. Expt. Sta. Pop. Bul. 187, 23 pp.
3. Chitwood, B. G. 1949. "Root-knot Nematodes." Part I. A revision of the genus Meloidogyne Goeldi, 1887. Proc. Helminth. Soc. Wash. 16: 90-104.

4. Christie, J. R. 1953. Ectoparasitic nematodes of plants. Phytopathology 43: 205-297.
5. Christie, J. R., and V. G. Perry. 1951. Removing nematodes from the soil. Proc. Helminth. Soc. Wash. 18: 106-108.
6. Goheen, A. C., and J. R. McGrew. 1954. Control of endoparasitic root nematodes in strawberry propagation stocks by hot-water treatments. Plant Dis. Reptr. 38: 818-826.
7. Graham, T. W., and Q. L. Holdeman. 1953. The sting nematode Belonolaimus gracilis Steiner: A parasite on cotton and other crops in South Carolina. Phytopathology. 43: 434-439.
8. Hildebrand, A. A. 1934. Recent observations on strawberry root rot in the Niagara Peninsula. Canad. Jour. Res., Sect. C., Bot. Sci. 11: 18-31.
9. Hildebrand, A. A. and P. M. West. 1941. Strawberry root rot in relation to microbiological changes induced in root rot soil by the incorporation of certain cover crops. Canad. Jour. Res. Sect. C., Bot. Sci. 19: 183-198.
10. Horn, N. L., and W. J. Martin. 1954. Plant parasitic nematodes in relation to strawberry culture in Louisiana (Abstr.). Phytopathology 44: 493.
11. Klinkenberg, Caroline H. 1953. Zwart wortelrot van aardbeien. Tijdschr. over Plantenziekten. 59: 261-262.
12. Sasser, J. N. 1954. Identification and host-parasite relationships of certain root-knot nematodes (Meloidogyne spp.). Maryland Agr. Expt. Sta. Tech. Bull. A-77.

LOUISIANA STATE UNIVERSITY AGRICULTURAL EXPERIMENT STATION,
BATON ROUGE, AND FRUIT AND TRUCK EXPERIMENT STATION,
HAMMOND, LOUISIANA

THE ROOT-KNOT NEMATODE, MELOIDOGYNE SPP., IN ISRAEL [1]

G. Minz [2]

The first attempt to describe species of Meloidogyne from Israel was made by Tarjan (11). Some of his identifications are included in this paper. The hosts (about 240 plant species) of root-knot nematode were described in successive papers from 1936 to 1954 (3-9).

Both fresh material and preserved specimens kept at the Plant Pathology Division were used for identification. The specimens were preserved either in formalin-acetic acid (2) or in 5% formalin. The collection dates back to 1918.

Three to 20 perineal patterns were made, but on the average 5 to 6 good patterns seemed to suffice. Several root-knots were used for dissection; where knots of different sizes were present, both large and small knots were dissected. Roots of plants left for a prolonged time in the soil sometimes revealed few species of Meloidogyne. In a few instances seedling roots also harboured more than one species.

The species found in the majority of cases was M. javanica, which is very widespread in this country.

With this, as with other species, the perineal patterns sometimes deviated from the characteristic description and photomicrographs (1, 10, 12); even so they could easily be categorized. The differentiation of M. incognita from its variety acrita was, however, sometimes difficult. In such doubtful cases slides or fixed material were sent to Mr. A. L. Taylor, Nematology Section, Beltsville, for consultation.

In all, five species of Meloidogyne Goeldi, 1887 were found from 162 samples, representing 70 species of plants:

Species	Plants	Localities
M. arenaria (Neal, 1889) Chitwood, 1949	15	5
M. hapla Chitwood, 1949	7	9
M. incognita (Kofoid & White, 1919) Chitwood, 1949	17	5
M. incognita var. acrita Chitwood, 1949	15	5
M. javanica (Treub, 1885) Chitwood, 1949	59	10

In general, no relation was found between the shape of root knots and the species of Meloidogyne found. However, M. hapla was always found in small knots. In Euphorbia pulcherrima knots were very numerous and exceeded 1 cm in diameter, but only few of them harboured a single female.

In several instances females or egg masses or both were found outside the roots. This was particularly true either with relatively small (thin) roots, or underdeveloped knots, or with Meloidogyne hapla.

A differential geographical distribution of Meloidogyne spp. can hardly be deduced from this investigation. This is why the localities are not included in the list. As more samples of plants (both of the same or different species from the same or from many localities) are collected and examined, it is likely that more species of Meloidogyne will be found. The same thing is true with old vs. new cultivated lands. In Rehovot and surroundings alone all five species were discovered. On the other hand, tomatoes, potatoes and gladioli collected from a number of localities, also revealed five, four and four species, respectively.

As already mentioned, M. javanica is the most widespread species encountered in Israel. The four are almost equally distributed; but M. hapla was found in more localities than the other three.

Literature Cited:

1. Chitwood, B. G. 1949. Root-knot nematodes - part I. A revision of the genus Meloidogyne Goeldi, 1887. Proc. Helminth. Soc. Wash. 16: 90-104.
2. Goodey, T. 1951. Laboratory methods for work with plant and soil

[1] Publication of the Agricultural Research Station, Rehovot, Israel, 1956 Ser. No. 160 E.

[2] Plant Pathologist.

The author wishes to express his thinks to Mr. A. L. Taylor for his kind cooperation. He appreciates also the assistance of Mrs. Ruth Berger and Miss Dina Harari.

Table 1. Species of Meloidogyne of some host-plants in Israel (1918-1956)

Host Plant	Species of Meloidogyne [a]				
	arenaria	hapla	incognita	incognita acrita	javanica
Agave victoriae-reginae [b]			+		+
Allium cepa					+
Allium schoenoprasum					+
Amaranthus caudatus	+			+	+
Angelica archangelica					+
Antirrhinum majus		+		+	+
Arachis hypogaea [b]		+			
Beta vulgaris (garden and sugar beet)					+
Beta vulgaris var. cicla	+				+
Beta vulgaris var. macrorhiza					+
Calendula sp.	(+)		(+)	+	+
Carica papaya					+
Chenopodium sp.					+
Chrysanthemum leucanthemum grandiflorum [b]					+
Citrullus vulgaris					+
Citrus aurantifolia var. dulcis					+
Cochlearia armoracia					+
Cucumis sativus			+	+	
Dahlia variabilis		(+)	(+)		+
Daucus carita				(+)	+
Dianthus caryophyllus					+
Dichondra repens	+		+		+
Echeveria sp.					+
Euphorbia pulcherrima					+
Ficus carica	+		+	+	
Fragaria x Ananassa		+			
Fraxinus syriaca [b]					+
Gladiolus sp.	+		+	+	+
Gomphrena sp.					+
Hibiscus cannabinus			+		+
Impatiens balsamina	+				
Ipomoea batatas					+
Ipomoea sp.			+	+	+
Lactuca sativa	+			+	+
Lagenaria vulgaris					+
Lathyrus odoratus	+			+	
Lavandula officinalis (= L. vera)					+
Luffa aegyptiaca				+	+
Lycopersicon esculentum	+	+	+	+	+
Morus sp.	+			+	

Table 1. (Cont.)

Host Plant	Species of Meloidogyne[a]				
	arenaria	hapla	incognita	incognita acrita	javanica
Musa cavendishii (= M. nana)[b]					+
Musa paradisiaca var. sapientium[b]					+
Nicotiana tabacum					+
Olea europaea					+
Petroselinum crispum			+		
Phaseolus vulgaris			+		+
Pisum sativum	+				+
Populus alba					+
Prunus amygdalus var. amara			+		+
Prunus carassia (sour)					+
Prunus persica					+
Punica granatum					+
Raphanus sativus					+
Raphanus sativus var. radicula					+
Ricinus communis			+		+
Salix viminalis[b]					+
Scabiosa sp.[b]	+			+	+
Scorzonera hispanica					+
Solanum melongena	+				+
Solanum tuberosum		+	+	+	+
Solanum villosum	+				+
Stillingia sebifera					+
Trifolium alexandrinum			+		
Valeriana italica (= V. dioscoridis)		+			
Valeriana officinalis			+		
Verbascum thapsus					+
Vigna sesquipedalis					+
Vigna sinensis					+
Vitis vinifera					+
Zea mays					+

[a] (+) means that one or two patterns only were seen.

[b] Hosts recorded for the first time during 1954 and 1955.
Additional hosts recorded in the same period are:
Begonia nelumbifolia
Carthamus tinctorius
Hibiscus esculentus

nematodes. Min. Agric. & Fish. Tech. Bull. 2.
3. Minz, G. 1936. The root-knot nematode. Hassadeh, 16: 35- 38, 94-95, 316-319.
4. Minz, G. 1940. The control of nematodes. Hassadeh, 20: 548-550, 565-567.
5. Minz, G. 1943. Additional list of plants affected by nematodes. Hassadeh 31 (6): 302.
6. Minz, G. 1946. Supplement to the host-plants of the root-knot nematode Heterodera marioni in Palestine, recorded 1.10. 39-30.9.45. Hassadeh 26: 271.
7. Minz, G. 1951. Supplement II to the host-plants of the root-knot nematode in Israel recorded 1.10.45-30.9.50. Hassadeh 31: 302.
8. Minz, G. 1953. A list of plants attacked by the root-knot nematode, Meloidogyne spp., in Israel, to 30th Sept., 1952. In: Plant Parasitic Nematodes. "Sifriath Hassadeh", Tel Aviv.
9. Minz, G. 1954. List of additional hosts of the root knot nematode, Meloidogyne spp. recorded 1.10.52-31.12.53. Hassadeh 34: 511.
10. Sasser, J. N. 1954. Identification and host-parasite relationships of certain root-knot nematodes (Meloidogyne spp). Univ. Maryland Bull. A-77.
11. Tarjan, A. C. 1953. Geographical distribution of some Meloidogyne spp. in Israel. Plant. Dis. Reptr. 37: 315-316.
12. Taylor, A. L., V. H. Dropkin, and G. C. Martin. 1955. Perineal patterns of root-knot nematodes. Phytopathology 45: 26-34.

AGRICULTURAL RESEARCH STATION, REHOVOT, ISRAEL

LEAF SCALD OF COTTON

C. H. Arndt

Abstract

Conditions under which cotton leaf scald occurs indicate that the injury is associated with infiltration of the leaf spaces with water during a midday rain shower and subsequent strong insolation.

Within the past 10 years, the writer in four instances has observed extensive and severe injury to the leaves of cotton plants that became noticeable within several days after midday rain showers accompanied by at least moderate winds. These showers, with which the injury was associated, invariably occurred after periods of low rainfall and relatively high temperatures, and were also followed by rapid clearing. This type of injury, or scald, was widespread in northeastern South Carolina after an early afternoon rain shower on June 1, 1956.

The injury first appeared as a blanched interveinal area, not unlike that produced by high temperatures. It soon became tan and then brownish. Within 2 weeks the affected area usually dried out, broke into pieces, and fell from the leaf. This note is an attempt to identify the conditions under which the injury may occur.

Horticulturists generally avoid wetting the foliage of plants during bright sunshine in the belief that such wetting may result in injury to the leaves. The possibility of water on the surface of leaves causing such injury has been questioned by Kramer (1). After attempts to induce this type of injury, he concluded that it must be much less common than is generally supposed. Scald of cotton leaves, however, does occur at times under environal conditions which he describes as "when the sun shines brightly immediately after a summer shower". Since the leaves of the cotton plant can be readily infiltrated with water during the middle of a sunny day (2), the writer believes that the injury to the leaves is associated with infiltration by water of the inter-cellular spaces in the leaves during the rain shower and the subsequent reduction of aeration within the leaves while they are subjected to strong insolation. The relation of wind to scald was clearly indicated in one terraced cotton field with well foliated, 3-foot plants but with a clear area between rows. In rows parallel to the direction of the wind, the injury was severe; while in the rows at right angles there was little or no injury.

Literature Cited

1. Kramer, P. J. 1939. The effect of drops of water on leaf temperature. Amer. Jour. Bot. 26: 1-14
2. Weindling, R. 1948. Bacterial blight of cotton under conditions of artificial inoculation. U. S. Dept. Agric. Tech. Bull. 956.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION

TWO STEMPHYLIUM DISEASES OF BLUE LUPINE[1]

Homer D. Wells, Ian Forbes, Thomas E. Webb, and John R. Edwardson[2]

Abstract

Little leaf spot of blue lupine, caused by Stemphylium botryosum Wall., is reported and described as a hitherto unrecognized disease of blue lupine in the United States. This disease is perhaps the same as that attributed to Macrosporium sarcinaeforme Cav. in Germany and Italy. The little leaf spot disease has been serious in the United States only in instances where alfalfa and blue lupine plantings were adjacent. White and yellow lupines were not susceptible to S. botryosum in artificial inoculation trials.

Gray leaf spot of blue lupines, caused by Stemphylium solani Weber, is described as a hitherto unrecognized disease of blue lupines. White and yellow lupines were not susceptible to S. solani in artificial inoculation trials.

Stemphylium botryosum Wall.

While examining the breeding lines of blue lupines (Lupinus angustifolius) at the North Florida Experiment Station, Quincy, Florida, on March 29, 1954, a leaf spot was noticed which did not appear to be typical of either brown spot caused by Pleiochaeta setosa (Kirchn.) Hughes, or anthracnose caused by Glomerella cingulata (Ston.) Spauld. & Schrenck, the two most common leaf-spotting diseases of blue lupines (6).

The leaf spots consisted of numerous fudge-colored (varying from vassar tan to rustic brown), circular lesions ranging in size from a pinpoint up to a millimeter in diameter (Fig. 1). The lesions, at first, appeared to be small deposits on the upper side of the leaves; however, with the aid of a 10X hand lens, it was readily determined that the spots were raised portions of the leaf tissue. The lesions appeared to be very shallow and did not penetrate through the leaf except in the most severe cases. Very frequently the adaxial side of a leaflet had 20 to 30 lesions visible, whereas the abaxial side of the leaflet failed to show the presence of more than one or two lesions. Pod and stem lesions were fudge-colored. In general, the pod lesions were small triangular-to-circular lesions of not more than 4 mm in the largest dimension, with most of the individual lesions being nearer to 1 or 2 mm. Stem lesions were much larger than pod and leaf lesions; they varied in outline from triangular to irregularly circular and measured up to 5 to 10 mm in the largest dimension. Numerous stem lesions, in some instances, came together to discolor entire stems. The pod and stem lesions, like the leaf lesions, did not appear to be deep-seated.

A microscopic examination of the diseased lesions showed the presence of fragments of septate mycelium but no fruiting structures, even when left in a moisture chamber for a prolonged period. However, surface-sterilized, diseased tissue platings on "V-8" juice agar yielded pure cultures of Stemphylium botryosum Wall. Typical conidia of S. botryosum from an isolate grown on 20% "V-8" juice agar are shown in Figure 2.

After the fungus was identified as S. botryosum, its possible association with an adjacent alfalfa field was realized. The alfalfa was examined and found to be severely infected with Stemphylium leaf spot. Stemphylium botryosum isolated from the alfalfa was identical with that obtained from the adjacent blue lupine nursery. Isolations from both hosts produced Pleospora herbarum Rabenh. in pure culture, giving additional proof of the identity of the pathogen. An ascus with ascospores of Pleospora herbarum from an isolate obtained from a pod lesion on blue lupine is shown in Figure 3.

---

[1]Cooperative investigations at Tifton, Georgia, Quincy and Gainesville, Florida, of the Field Crops Research Branch, Agricultural Research Service, United States Department of Agriculture, the University of Georgia Coastal Plain Experiment Station, the North Florida Experiment Station, and the Agricultural Experiment Station of the University of Florida. Published with the approval of the Director of the Georgia Coastal Plain Experiment Station, Tifton, Georgia, as Journal Series Paper No. 37.

[2]Pathologist and Agronomist, Field Crops Research Branch, Agricultural Research Service, Tifton, Georgia; Assistant Agronomist, North Florida Experiment Station, Quincy, Florida; and Assistant Agronomist, Agricultural Experiment Station of the University of Florida, Gainesville, Florida respectively.

FIGURES 1 to 3: Stemphylium botryosum.

1 -- Common bitter blue lupine leaf showing natural infection.

2 -- Isolate from blue lupine on 20% "V-8" juice agar. About 344X.

3 -- Pleospora herbarum from an isolate of S. botryosum from blue lupine grown on 1% "V-8" juice agar. About 344X.

Cross inoculation trials conducted in the greenhouse at Tifton, Georgia, showed that S. botryosum from either alfalfa or blue lupines reproduced comparable symptoms on the reciprocal host. This demonstrated that no strain difference existed between the isolates obtained from the two hosts. White and yellow lupines (L. albus and L. luteus) appeared to be immune from attack by this organism in greenhouse artificial inoculation tests.

Since its initial discovery, leaf spotting caused by S. botryosum has been observed at Gainesville, Florida; Tifton, Dublin, Bartow and Albany, Georgia. In most instances, the disease has not caused serious losses. During the spring of 1955, however, a 10-acre planting of Borre sweet blue lupine near Albany, Georgia, was completely killed by this disease. This planting had a strip of alfalfa through the middle of the field which appeared to be the primary source of inoculum. The alfalfa leaf spots were covered with an abundance of conidia, whereas no conidia could be found on the diseased lupine (although S. botryosum was readily obtained by isolation). The significant difference in the ability of S. botryosum to sporulate on the different hosts suggests that S. botryosum may not be a problem on blue lupines except where lupines are grown adjacent to alfalfa or some other host on which the fungus sporulates readily.

Owing to the small size of the lesions produced, the name "little leaf spot" is proposed as the common name for this Stemphylium disease on blue lupines.

Stemphylium solani Weber

At the request of the county agent, a visit was made on March 1, 1956, to check on diseases of blue lupines at the South Georgia Wildlife Management and Demonstration Farm located 10 miles west of Albany, Georgia. Three fields totaling about 50 acres were badly damaged by disease, with large areas almost completely killed as shown in Figure 4.

Some brown spot, caused by Pleiochaeta setosa, was present but was not sufficiently abundant to be considered the primary or major reason for the badly diseased condition of the lupine. A hitherto unrecognized leaf spot appeared to be the major cause of the injury.

The leaf spots were circular to oblong in outline, ranging from 2 to 6 mm in diameter. During early stages of development, the leaf spots were kaffa brown on the upper and lower surfaces. On the older lesions, the central portion of the leaf spot bleached to rose gray, leaving

FIGURES 4 to 7: Stemphylium solani. 4 -- Field of common bitter blue lupine almost completely killed by gray leaf spot, at the South Georgia Wildlife Management and Demonstration farm 10 miles west of Albany. 5 -- Borre sweet blue lupine leaves showing natural infection. 6 -- At bottom is a Borre sweet blue lupine showing natural infection. At top is a healthy stem. 7 -- Isolate from blue lupine grown on 20% "V-8" juice agar. About 344X.

a well defined kaffa brown margin. The upper side of the lesion bleached more rapidly than the lower side. The leaf spot apparently caused collapse of the tissue, resulting in the lesion being sunken on both the upper and lower surfaces. Typical leaf-spot symptoms are shown in Figure 5. Two or three leaf spots appeared to be all that were required to cause a leaflet to fall. Thus, the disease is capable of causing rapid defoliation of plants. Stem and pod lesions were dark brown to cinnamon in color, from a few millimeters in diameter up to several inches in length, and extended completely around the stem or involved an entire pod in many instances. A typical stem lesion is shown in Figure 6.

Microscopic examination of the leaf spot showed the presence of fragments of septate mycelium but no fruiting structures. However, a microscopic examination of the stem lesions revealed the presence of conidia and conidiophores belonging to the genus Stemphylium. Surface-sterilized, diseased tissue plated on "V-8" juice agar yielded pure cultures of a Stemphylium. This Stemphylium has been tentatively identified as S. solani Weber. Typical conidia of S. solani isolated from blue lupine and grown on "V-8" juice agar are shown in Figure 7.

The S. solani isolate from blue lupines reproduced the disease on blue lupine and caused typical gray leaf-spot symptoms (5) on tomatoes in the greenhouse. The organism was re-isolated from these hosts. No symptoms were produced on yellow and white lupines.

After the original discovery of S. solani as a pathogen of blue lupines, a check was made of the Stemphylium isolates obtained from blue lupine during the past two years. One isolate, 1955-24-B, isolated from a Borre sweet blue lupine leaf spot on April 19, 1955, at Tifton and labeled only as "Stemphylium ?" proved to be S. solani. All other previous Stemphylium isolates proved to be S. botryosum.

Since its initial discovery, leaf spotting of blue lupine, caused by S. solani, has been ob-

served at Tifton, Statesboro, Waynesboro, Vidette, Louisville, Bartow, Valdosta, Hahira, Quitman, Bainbridge, Camilla, and Moultrie, Georgia, and at Gainesville and Quincy, Florida. The amount of damage from S. solani varied from negligible in most instances to almost complete defoliation of entire plantings in other instances.

Weber (5) named the disease on tomatoes caused by S. solani "gray leaf spot." It is proposed that the disease caused by S. solani on blue lupine also be called "gray leaf spot."

Discussion

Richter (3) reported Macrosporium sarcinaeforme Cav. as the causal organism of a new leaf blight of blue lupine in Germany in 1937. His description and pictures of the disease agree with that of the little leaf spot disease described in this paper. Petri (2) reported Macrosporium sarcinaeforme Cav. to be associated with total defoliation of a lupine planting near Rome, Italy, in 1939. Before Wiltshire's studies (7), much confusion existed between (Macrosporium sarcinaeforme Cav.) = Stemphylium sarcinaeforme (Cav.) Wilt., and (Macrosporium sarcinula Berk. and Macrosporium parasiticum Thuemen) = Stemphylium botryosum Wall., and since according to Neergaard (1) S. sarcinaeforme has been reported with certainty only on clover, it is very likely that the disease in Germany (3) and Italy (2) was also caused by S. botryosum.

Additional reports of Stemphylium botryosum on lupines include isolations from seed by Neergaard (1) in Denmark, and Pleospora herbarum (ascomycete stage of S. botryosum recorded on Lupinus spp. in North America by Seymour (4).

Insofar as can be ascertained, Stemphylium solani, the causal organism of the gray leaf spot, has not been reported previously as causing a disease of blue lupine.

Literature Cited

1. Neergaard, Paul. 1945. Danish species of Alternaria and Stemphylium. Copenhagen, Denmark. Einar Munksgaard, Publisher.
2. Petri, L. 1940. Rassegna dei cosi fitopatologici osservati nel 1939. Roma, Stazione di Pathologia Vegetale, Bolletino 20. N.S. 1.
3. Richter, H. 1938. Lupinenkrankheiten. Mitt. Biol. Anst. (Reichsanst.), Berlin, 58: 87-101.
4. Seymour, Arthur Bliss. 1929. Host index of the fungi of North America. Cambridge, Massachusetts. Harvard University Press.
5. Weber, George F. 1930. Gray leaf spot of tomatoes caused by Stemphylium solani sp. nov. Phytopathology 20: 513-518.
6. Weimer, J. L. 1952. Diseases of cultivated lupines in the Southeast. U. S. Dept. Agric. Farmers' Bulletin 2053.
7. Wiltshire, S. P. 1938. The original and modern concepts of Stemphylium. Trans. British Myc. Soc. 21: 211-239.

UNITED STATES DEPARTMENT OF AGRICULTURE, AGRICULTURAL RESEARCH SERVICE; UNIVERSITY OF GEORGIA COASTAL PLAIN EXPERIMENT STATION; NORTH FLORIDA EXPERIMENT STATION; AND AGRICULTURAL EXPERIMENT STATION OF THE UNIVERSITY OF FLORIDA

DISEASES OF FORAGE CROPS BEFORE THE FIRST HARVEST OF HAY IN NEW YORK, 1956

D. A. Roberts and C. H. Ward

For the fifth consecutive year, a survey was made of diseases of forage crops in New York. Itineraries were planned so that each of the chief forage production areas of the State was visited and so that representative fields within each area were inspected (4, 6). Estimates were made of percentages of crop losses caused by some leaf and stem diseases that occurred most frequently in 50 meadows (Table 1).

Table 1. Estimate of crop losses caused by some stem and leaf diseases of forage legumes and grasses before the first hay harvest in New York, 1956.

Crop and disease[a]	Pathogen[a]	Estimated percentage loss
ALFALFA		
Black stem	Ascochyta imperfecta	3.0
RED CLOVER		
Spring black stem	Phoma trifolii	1.5
Northern anthracnose	Kabatiella caulivora	1.3
Target spot	Stemphylium sarcinaeforme	1.0
WHITE AND LADINO CLOVERS		
Pepper spot	Pseudoplea trifolii	0.5
BIRDSFOOT TREFOIL		
Leafspot and stem canker	Stemphylium loti	1.0
TIMOTHY		
Eyespot	Heterosporium phlei	1.0
BROME GRASS		
Brown spot	Pyrenophora bromi	2.3

[a]Names as listed by Kreitlow et al. (3)

Although losses due to the black stem diseases of alfalfa and red clover, northern anthracnose of red clover, and brown spot of brome grass were relatively high, only negligible losses were caused by other diseases of above-ground parts of forage crops. Consequently, total hay losses brought about by diseases were lower in 1956 than in any previous year in which forage crops disease surveys were made in New York (2, 4, 5, 6, 7). In most fields of alfalfa and red clover, Pseudopeziza leafspots occurred in only trace amounts. Brown stripe of orchard grass and timothy and leaf scald of both brome and orchard grasses caused negligible losses. Probably the observed low disease severity resulted from unusually cold weather that occurred during the spring of 1956.

In Table 2 are listed those forage crops diseases that were observed in New York before the first hay harvest of 1956, but for which no estimates of losses were made.

Table 2. Diseases of forage crops observed before the first harvest of hay in New York in 1956, but for which no estimates of crop losses were made.

Crop and disease [a]	Pathogen [a]
ALFALFA	
Alfalfa mosaic [b]	Alfalfa mosaic virus
Bacterial wilt	Corynebacterium insidiosum
Pseudopeziza leafspot	Pseudopeziza medicaginis
Leaf spot and root rot [b]	Leptosphaeria pratensis [b]
Pepper spot	Pseudoplea sp.
Sclerotinia crown and stem rot	Sclerotinia trifoliorum
RED CLOVER	
Red clover vein mosaic	Red clover vein mosaic virus
Mosaic	Virus not identified
Root rots	Fusarium spp. and other fungi
Sooty blotch	Cymadothea trifolii
Pseudopeziza leafspot	Pseudopeziza trifolii
Powdery mildew	Erysiphe polygoni
Rust	Uromyces trifolii fallens
WHITE AND LADINO CLOVERS	
Mosaic	Alfalfa mosaic virus
Root and stolon rots	Fusarium spp. and other fungi
Cercospora leaf and stem spot	Cercospora zebrina
Pseudopeziza leafspot	Pseudopeziza trifolii
Leaf spot and root rot [b]	Leptosphaeria pratensis [b]
TIMOTHY	
Leaf scald [b]	Rhynchosporium secalis [b]
Brown stripe	Scolecotrichum graminis
Stripe smut	Ustilago striiformis
BROME GRASS	
Leaf scald	Rhynchosporium secalis
ORCHARD GRASS	
Purple leafspot	Stagonospora maculata
Scald	Rhynchosporium orthosporum
Brown stripe	Scolecotrichum graminis
Mastigosporium leaf fleck [b]	Mastigosporium rubricosum [b]
Powdery mildew	Erysiphe graminis

[a] Names as listed by Kreitlow et al. (3), except where stated otherwise.
[b] Names as listed by Dickson (1).

Literature Cited:

1. Dickson, J. G. 1947. Diseases of Field Crops. McGraw-Hill, New York. 429 p.
2. Horsfall, J. G. 1930. A study of meadow-crop diseases in New York. New York (Cornell) Agr. Exp. Sta. Memoir 130, 139 p.
3. Kreitlow, K. W., J. H. Graham, and R. J. Garber. 1953. Diseases of forage grasses and legumes in the north-eastern states. Pennsylvania Agr. Exp. Sta. Bul. 573, 42 p.
4. Roberts, D. A., R. T. Sherwood, and K. D. Fezer. 1952. Diseases of forage crops in New York, 1952. Plant. Dis. Reptr. 36: 416-418.
5. _____, K. D. Fezer, and R. T. Sherwood. 1954. Diseases of forage crops in New York, 1953. Plant Dis. Reptr. 38: 30-31.
6. _____, R.T. Sherwood, K. D. Fezer, and C. S. Ramamurthi. 1955. Diseases of forage crops in New York, 1954. Plant Dis. Reptr. 39: 316-317.
7. _____, K. D. Fezer, and C. S. Ramamurthi. 1956. Diseases of forage crops in New York, 1955. Plant Dis. Reptr. 40: 219-221.

DEPARTMENT OF PLANT PATHOLOGY, CORNELL UNIVERSITY, ITHACA, NEW YORK

PHYSIOLOGIC RACES OF CROWN RUST OF OATS IDENTIFIED IN 1955 [1]

M. D. Simons [2]

Summary

One new race of crown rust (Puccinia coronata var. avenae), assigned number 289, was discovered by Cruikshank in New Zealand.

A total of 383 isolates distributed among 18 races were identified from uredial material collected in the United States, Canada, and Mexico during 1955. Race 202 accounted for 47 percent of the total; race 203 for 19 percent; and race 258 for 6 percent. A total of 166 isolates, distributed among 15 races, were identified from aecial material collected primarily from Rhamnus cathartica. Races 202 and 203 accounted for 42 and 23 percent, respectively, of the total. Races attacking Victoria were somewhat more common in this material than in the uredial material.

No isolates from either uredial or aecial material were found that were capable of attacking Landhafer, Santa Fe, Trispernia, or Bondvic.

Since the last compilation of previously unnumbered races of crown rust (Puccinia coronata Cda. var. avenae Fraser & Led.) was made[3], the discovery of one new race has been brought to the attention of the author. Cruikshank[4] reported a race in New Zealand that attacked Anthony and Saia, but the remaining eight differential varieties were resistant.

A total of 402 collections of crown rust on oats made in 28 States or comparable areas in 1955 were received at Ames, Iowa. This represented a considerable decrease below the 704 collections received in 1954, which is probably partly explained by the relatively light infection of crown rust in many parts of the country during 1955. All collections containing viable urediospores were increased on a completely susceptible variety of oats, and then used to inoculate the new set of 10 differential varieties. Observation of infection on the differentials showed that many of the collections represented mixtures of different races of crown rust. Ordinarily, single pustule isolates were made from such mixtures; however, the component races of 32 of these mixed collections were never positively identified.

The 383 isolates that were identified were distributed among 18 races (Table 1). As in the past few years, race 202 was the most common, accounting for 47 percent of all the isolates. This was an increase of 17 percent over 1954, but was about the same as 1953. Race 202 attacks the Anthony, Appler, and Bond varieties. The remaining differentials, Victoria, Landhafer, Santa Fe, Ukraine, Trispernia, Bondvic, and Saia are resistant. Race 203, which was second in prevalence and constituted about 19 percent of the total isolates, differs from race 202 only by its ability to attack Ukraine.

As in 1954, race 258 was third in prevalence, accounting for 6.5 percent of all isolates. However, this represented a decrease from about 14 percent in 1954. Race 258 attacks Victoria but Bond is resistant. The two next most common Victoria races, 216 and 213, accounted for 5.5 and 4.2 percent, respectively, of the total. All Victoria races combined comprised about 18 percent of the total as compared to about 30 percent in 1954. Data obtained in 1954 indicated that Victoria races were relatively much more prevalent in the Southeastern States than elsewhere in the country. This same trend was apparent in 1955 (Table 1). The Victoria races comprised about two-thirds of all isolates identified from the Southeastern States in 1955, and the overall decrease in prevalence of these races is probably only a reflection of the fact that relatively fewer collections were received from this region in the year.

---

[1] Cooperative investigation between the Field Crops Research Branch, Agricultural Research Service, United States Department of Agriculture, and the Iowa Agricultural Experiment Station, Journal Paper No. J-2948. Project No. 1176. The writer wishes to acknowledge his indebtedness to I. M. Cruickshank who generously made his data available, and to investigators in the United States, Canada, and Mexico who supplied crown rust collections for identification.

[2] Plant Pathologist, Field Crops Research Branch, Agricultural Research Service, United States Department of Agriculture, Iowa State College, Ames, Iowa.

[3] Simons, M. D. 1955. Physiologic races of crown rust of oats identified in 1954. Plant Dis. Reptr. 39: 949-955.

[4] I. M. Cruikshank, 1956. Manuscript to be submitted to New Zealand Jour. Sci. and Tech. Section B.

Table 1. Physiologic races of Puccinia coronata avenae isolated from oats in 1955[a]

Area and Location	Prevalence and distribution of physiologic races:																			Total	
	201	202	203	205	209	210	211	212	213	216	226	231	237	241	258	259	284	285		Isolates	Races
NORTH CENTRAL																					
Illinois	2	12	1										1							16	4
Indiana		4																		4	1
Iowa		28	11					3		2					2			1		47	6
Kansas		3		1										1	1					6	4
Manitoba									1	1		1		1						4	4
Michigan		3	2																	5	2
Minnesota		2							1				1							4	3
Missouri	1	4	9				1			2			1	1						19	7
Nebraska		2							1											3	2
North Dakota	1	7	4						1	1										14	5
Ohio		3	1																	4	2
South Dakota	1	1	1																	3	3
Wisconsin	3	24	29		1		1	1	1					1			1			62	9
Total	8	93	58	1	1		2	4	5	6		1	3	4	3		1	1		191	15
Percent	4.2	48.7	30.4	0.5	0.5		1.0	2.1	2.6	3.1		0.5	1.6	2.1	1.6		0.5	0.5			
EASTERN																					
Maine	1	1				1											1			4	4
Pennsylvania	3	4			1		1	1									1			11	6
SOUTH CENTRAL																					
Arkansas															2					2	1
Kentucky	1	3																		4	2
Louisiana		1																		1	1
Mexico		8											6							15	3
Mississippi		3									1				1					4	2
Oklahoma		16	4						2	1					1					24	5
Tennessee	2	4																		6	2
Texas	2	39	5	2					2		1		2		1					54	8
Total	5	74	9	2					4	1	2		8		5					110	9
Percent	4.5	67.3	8.2	1.8					3.6	0.9	1.8		7.3		4.5						
SOUTHEASTERN																					
Florida	1	3	3						3	1			3		17	1				32	8
Georgia		4	2						4	5			2			3				20	6
North Carolina			2								1									3	2
South Carolina		1								8						2				11	3
Total	1	8	7						7	14	1		5		17	6				66	9
Percent	1.5	12.1	10.6						10.6	21.2	1.5		7.5		25.7	9.0					
WESTERN																					
California													1							1	1
Grand Total	18	180	74	3	2	1	3	5	16	21	3	1	17	4	25	6	3	1		383	18
Percent	4.7	47.0	19.3	0.8	0.5	0.3	0.8	1.3	4.2	5.5	0.8	0.3	4.4	1.0	6.5	1.6	0.8	0.3			
Locations	11	24	13	2	2	1	3	3	9	8	3	1	8	4	7	3	3	1			
Areas	3	3	2	2	2	1	2	2	2	2	1	1	3	1	2	1	2	1			

[a] The data in this table were obtained from both pure and mixed collections of crown rust. The identity of the racial components of 32 additional collections was not positively determined and consequently has not been included.

Table 2. Physiologic races of Puccinia coronata avenae isolated from Rhamnus spp. in 1955.[a]

State	Prevalence and distribution of physiologic races:															Total	
	201	202	203	205	211	212	213	216	232	237	241	258	274	279	285	Isolates	Races
Illinois		4	2	1			1	2			1					11	6
Iowa	2	57	33	3	2	1	14	11	1	1	5	3	1		1	135	14
Minnesota	1	1														2	2
Nebraska								1								1	1
Oregon								1								1	1
South Dakota		1	1				1									3	3
Wisconsin	2	7	3											1		13	4
Total	5	70	39	4	2	1	16	15	1	1	6	3	1	1	1	166	15
Percent	3.0	42.2	23.5	2.4	1.2	0.6	9.6	9.0	0.6	0.6	3.6	1.8	0.6	0.6	0.6		

[a] The data in this table were obtained from pure and mixed collections of crown rust. The identity of the racial components of 14 additional collections was not positively determined, and consequently has not been included.

Race 201, which appears to be very similar to the common race 202, comprised about 5 percent of the total. Race 237, which attacks neither Bond nor Victoria, made up about 4 percent. No other single race accounted for as much as 2 percent.

Three races of crown rust (263, 264, and 276) that have been identified in North America, and that attack the sources of resistance commonly being used in the United States at this time, such as Landhafer, Santa Fe, Trispernia, and Bondvic, were not found in the 1955 collections. Consequently, it would appear that these races are still extremely rare in North America.

A total of 172 aecial collections, mainly from Rhamnus cathartica, were received in the spring of 1955. These were first increased on a susceptible variety of oats and then treated like the uredial collections. Except for a single collection, all of this material was from the North Central States.

In general, the distribution of the 15 races (Table 2) identified among the 166 isolates was much the same as that for the uredial collections. Thus, the 2 most common races, 202 and 203, comprised 42 and 23 percent, respectively, of the total. Races attacking Victoria, primarily 213 and 216, however, were perhaps significantly more common in this material than in the uredial material from the Northern States.

Three races, 232, 274, and 279, that had not appeared in the uredial material, were identified from the aecial collections. These races, however, were rare and are not of special interest. The remainder of the 15 races were likewise each identified only once or a few times, and represent no special menace to the varieties of oats now being used as sources of resistance to crown rust in the United States.

FIELD CROPS RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE, AND IOWA AGRICULTURAL EXPERIMENT STATION, AMES, IOWA.

CULTURING RHYNCHOSPORIUM SECALIS [1]

Richard D. Schein and John W. Kerelo [2]

Cereal pathologists and breeders working with the barley scald organism, Rhynchosporium secalis (Oud.) Davis, have experienced considerable difficulty in isolating the organism from infected tissue and in culturing the fungus for inoculation of plants. Recent work in this laboratory has demonstrated means of accomplishing these ends with little difficulty and the techniques used are reported here for use by others confronted with this problem.

Table 1. Sporulation of Rhynchosporium secalis on various media.

Medium	Millions of spores per ml. [a]
Potato-dextrose agar	0
Water agar	0
Nutramigen agar	.06
Oatmeal agar	.5
Cornmeal-oatmeal agar	.5
Barley leaf infusion agar	.67
Yeast extract agar	.67
Barley grain decoction agar	.69
Cornmeal agar	.71
Rice polish agar	1
Wheat bran agar	2.13
V-8 juice agar	2.64
Malt extract agar	3.13
Lima bean-malt extract agar	3.96
Potato-sucrose agar	8.86
Lima bean agar	15.52

[a] 50 ml flasks containing the media were seeded with 1 drop (approximately 400 spores) of an assayed suspension. After 16 days, spores were harvested by adding 10 g of 3 mm glass beads and 5 ml water to each flask and shaking each of three complete replicates simultaneously for 5 minutes on a Burrel shaker. Spore counts were then made with a Spencer Bright-line Haemocytometer.

Isolation of Rhynchosporium is difficult because its slow growth allows almost any contaminant to take over. Use of mercuric chloride followed by sterile water rinses, a technique requiring several transfers of tissue pieces, increases the probability of contamination. In addition, the fungus is very sensitive to the slightest amounts of mercuric chloride and unless rinsing is thorough, no growth will result. These difficulties have been obviated by the use of the following technique:

[1] Contribution No. 209 of the Department of Botany and Plant Pathology, Pennsylvania Agricultural Experiment Station. Authorized for publication July 23, 1956 as paper No. 2075 in the Journal Series.

[2] Respectively, Assistant Professor of Plant Pathology and Graduate Assistant, Pennsylvania State University.

1. Tissue pieces are wetted for 15-20 seconds in 70% ethyl alcohol.
2. Tissue is transferred to sodium hypochlorite (commercial grade, 5.25% by weight) diluted 1:9 with water.
3. Tissue is soaked for 90 seconds, making sure pieces are submerged. Pieces soaked 60 seconds will often yield contaminated cultures; those soaked 2 minutes or longer will be sterile with no Rhynchosporium growth.
4. Pieces are transferred to agar slants directly. Do not rinse.

Growth should be visible in 5 to 7 days when tubes are placed in 18°-20° C chambers.

Rhynchosporium secalis grows very slowly in culture. On potato-dextrose agar sporulation is practically nil. For inoculation studies, most workers prefer a relatively pure spore suspension. A study, the results of which are shown in Table 1, indicated several media which allow a high amount of sporulation. Media without sugar allow greatest sporulation; sucrose in the medium allows more sporulation than dextrose according to another study.

Since completion of these tests, lima bean agar (Difco) has been used in all isolation and culture work. Usually, 23 grams of the commercial preparation (8 g lima bean infusion, 15 g agar) plus 5 grams pure agar are used per liter.

Growth of Rhynchosporium on this medium is not rapid but the small colonies are almost completely spores. To obtain high numbers of spores per culture tube, a zigzag smear technique is used. The resulting culture is quite yeastlike in macroscopic appearance and will yield 30 million or more spores. All isolates grown on this medium had a pink color quite in contrast to the brown and black colonies on other media.

Rhynchosporium orthosporum Cald. also sporulates well on this medium.

DEPARTMENT OF BOTANY AND PLANT PATHOLOGY, THE PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK, PENNSYLVANIA

A SELECTIVE MEDIUM FOR THE ROUTINE ISOLATION OF GRAPHIUM ULMI SCHWARZ

I. R. Schneider[1, 2]

Each growing season, hundreds of elm specimens are cultured at the laboratory of the Illinois State Natural History Survey to determine if the causal agent of the Dutch elm disease (Graphium ulmi Schwarz, the imperfect stage of Ceratostomella ulmi Buisman) is present. Diagnosis is not always possible as a result of growth arising from air contaminants and several organisms (Dothiorella, Cephalosporium, Fusarium, Verticillium, and bacteria) sometimes emerge from elm chips. This interference by organisms other than G. ulmi is aided by the accumulation of large numbers of specimens from the field and the unavoidable long intervals between the culturing of specimens and the subsequent examination of cultures.

The antibiotic cycloheximide[3, 4] seemed a possible key substance in a selective medium to aid in minimizing such interference, since the compound has anti-fungal activity (1, 2, 4, 5), yet it does not inhibit G. ulmi to any important extent (3). Streptomycin (sulfate)[5] appeared likely to be another useful constituent of the selective medium, as it also has little effect on the growth of the Dutch elm disease fungus (3) and is known to inhibit many gram-positive and gram-negative bacteria (1).

Experiments and Results

The effect of Difco PDA containing 10 ppm streptomycin sulfate and either 200 ppm cycloheximide (Treatment 1) or 300 ppm cycloheximide (Treatment 2) on diameter growth of isolates of Penicillium sp., Aspergillus sp., Alternaria sp., Dothiorella sp., Cephalosporium sp., Fusarium sp., Verticillium sp., and Graphium ulmi was determined. Agar disks, each 5 mm. in diameter, were cut with an alcohol-flamed cork borer from the periphery of a colony of the fungus to be tested, and transferred inverted to the center of a Petri dish containing Difco PDA alone (control) or cycloheximide plus streptomycin sulfate combined with the Difco PDA. The cultures were incubated 1 week at 24°, C, and diameter measurements were recorded in two directions at right angles to each other and averaged. Each control and antibiotic treatment was replicated three times in any one trial.

From the data obtained, the percent inhibition of colony diameter growth attributable to the presence of cycloheximide and streptomycin in the medium was calculated (Table 1). The data indicate that both Treatments 1 and 2 resulted in high retardation of growth of all organisms tested except G. ulmi and Alternaria sp.; the latter was significantly inhibited, however. Representative cultures of the organisms tested in this manner are illustrated in Figure 1. Similar results were obtained with other isolates of the same organisms.

Up to the present writing, 24 elm specimens[6] suspected of harboring the Dutch elm disease fungus have been cultured in 1956. Cultures were made on medium with and without 200 ppm cycloheximide plus 10 ppm streptomycin sulfate, and the results were compared. Sixteen of the 24 specimens were cultured on freshly prepared PDA (with and without antibiotics) and all 24 specimens were cultured on Difco PDA (with and without antibiotics). The wood chips were placed on the agar in the usual manner, successive chips from a continuous series going to a plate without antibiotics (control plate), then to a plate containing antibiotics, then to a plate without antibiotics, etc., until there were 8 chips on each plate. Incubation was at 24° C, and readings were made 4 to 9 days later. Data were taken on the number of positive G. ulmi isolations, the number of cultures with a fungus other than G. ulmi emerging from chips, and the number of air contaminants (Table 2). On the medium containing antibiotics, fewer colonies

---

[1] Present address: Horticultural Crops Research Branch, United States Department of Agriculture, Plant Industry Station, Beltsville, Maryland.

[2] The author wishes to thank Dr. R. J. Campana of the Illinois State Natural History Survey for his suggestion of the problem, and his cooperation during its progress.

[3] Cycloheximide is the generic name for the compound Beta-((2-(3, 5-dimethyl-2-oxocyclohexyl)-2-hydroxyethyl))-glutarimide for which The Upjohn Company adopted "Acti-dione" as its trademark.

[4] The author appreciates the supply of cycloheximide made available by Dr. William Klomparens of The Upjohn Company.

[5] The author appreciates the supply of streptomycin sulfate made available by Dr. Louis G. Nickell of Charles Pfizer and Co.

[6] The author is indebted to Mr. E. Himelick and Mr. F. Stokes of the Illinois State Natural History Survey for collecting and culturing these specimens.

Table 1. Percent inhibition of colony diameter growth in the presence of cycloheximide and streptomycin.

Organism	Treatment	Colony diameter of control (average mm.)	Percent inhibition of colony diameter (average)
Graphium ulmi	1[a]	68	9
Graphium ulmi	2[b]	68	16
Penicillium sp.	1	42[c]	91
Penicillium sp.	2	42[c]	100
Aspergillus sp.	1	49[c]	79
Aspergillus sp.	2	49[c]	90
Alternaria sp.	1	90	32
Alternaria sp.	2	90	31
Cephalosporium sp.	1	61	85
Cephalosporium sp.	2	61	87
Dothiorella sp.	1	56	100
Dothiorella sp.	2	56	100
Verticillium sp.	1	26	100
Verticillium sp.	2	26	100
Fusarium sp.	1	58	86
Fusarium sp.	2	58	90

[a] Treatment 1: Medium containing 200 ppm cycloheximide and 10 ppm streptomycin sulfate.

[b] Treatment 2: Medium containing 300 ppm cycloheximide and 10 ppm streptomycin sulfate.

[c] In addition, many new colonies developed on the control dish, practically covering it. No new colonies occurred in either treatments 1 or 2.

arising from air contamination occurred and fewer cultures had other fungi emerging from plated chips than on corresponding controls. The Dutch elm disease fungus was isolated from more samples on medium containing antibiotics than on control medium, but the number of positive cases from the 24 specimens was small. However, in at least 12 of the cases where the Dutch elm disease fungus was not obtained, enough fungal growth occurred on control plates either from chips or from air contamination to seriously hamper identification of G. ulmi, had it been present. In no case did this occur on medium with 200 ppm cycloheximide and 10 ppm streptomycin sulfate present.

The growth and appearance of Graphium ulmi do not appear to be altered by the use of medium containing cycloheximide and streptomycin sulfate. Sporulation is good, and the general colony appearance is the same, although on fresh PDA a smaller amount of coremia may be formed (Fig. 2). Further testing of PDA containing cycloheximide and streptomycin as a potential selective medium for the isolation of G. ulmi is planned at this laboratory. Tests indicate

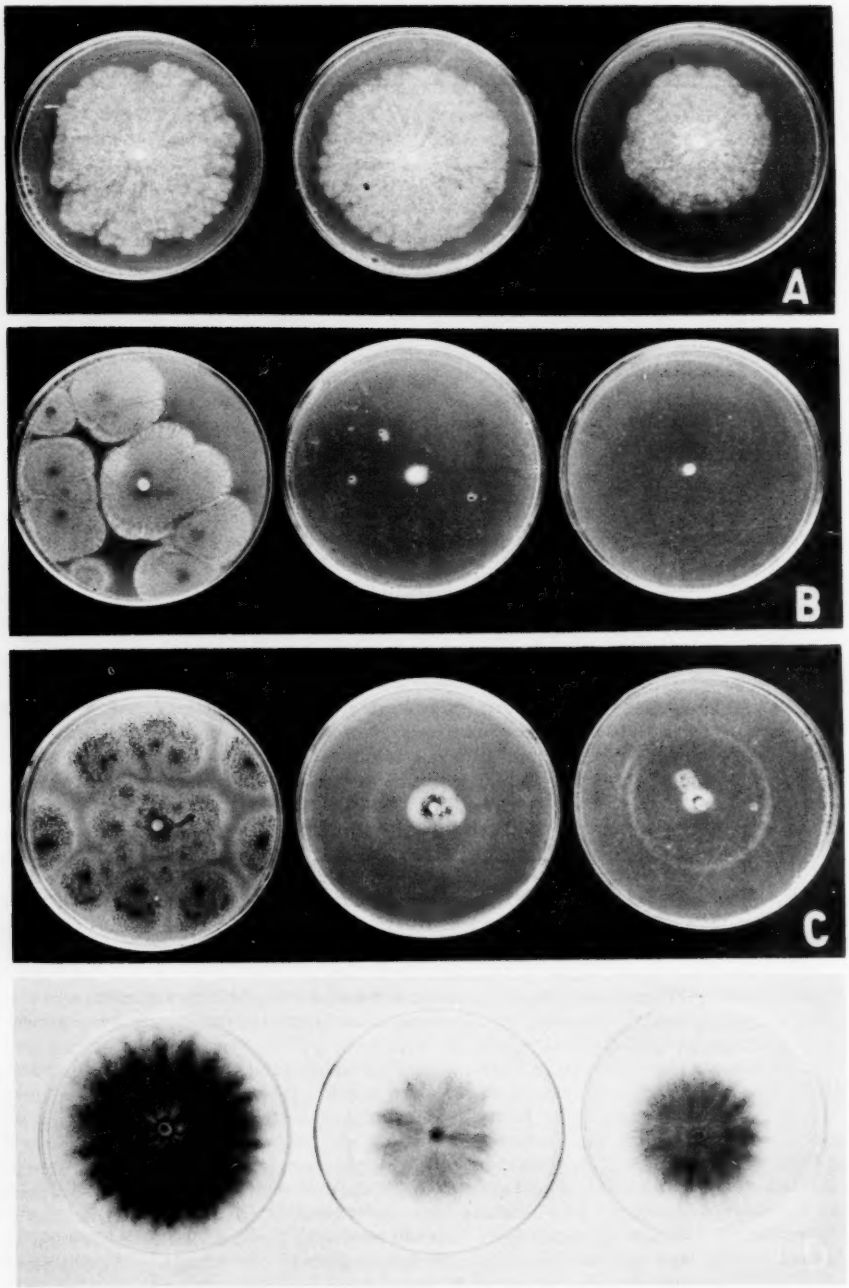


FIGURE 1. The effect of cycloheximide and streptomycin sulfate incorporated in medium on the diameter growth of eight fungi. For each organism the left-hand plate is the control (no antibiotic); the center and right-hand plates contain cycloheximide at 200 and 300 ppm respectively, as well as 10 ppm streptomycin sulfate in each plate.

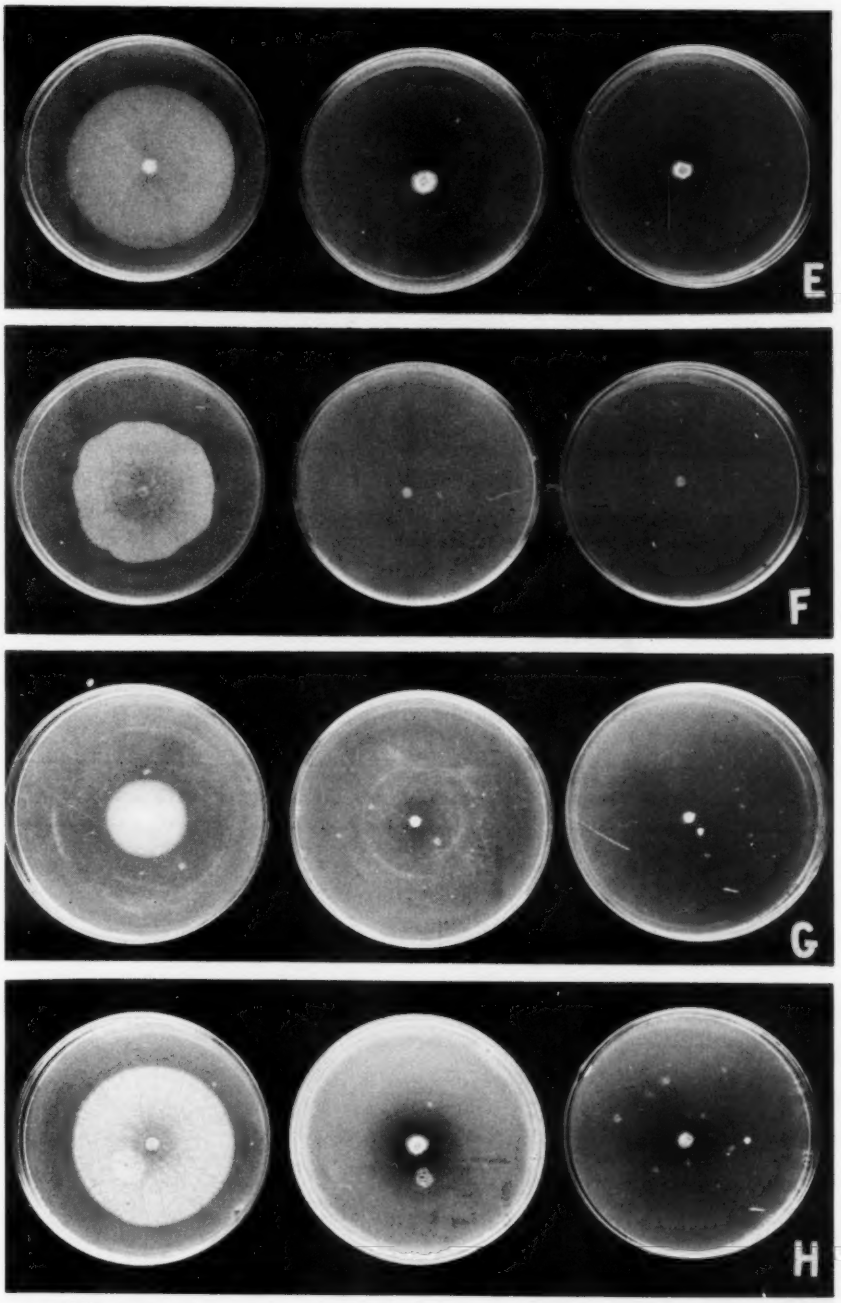


FIGURE 1. (Cont.)

A -- Graphium ulmi
B -- Penicillium sp.
C -- Aspergillus sp.
D -- Alternaria sp.
E -- Cephalosporium sp.
F -- Dothiorella sp.
G -- Verticillium sp.
H -- Fusarium sp.

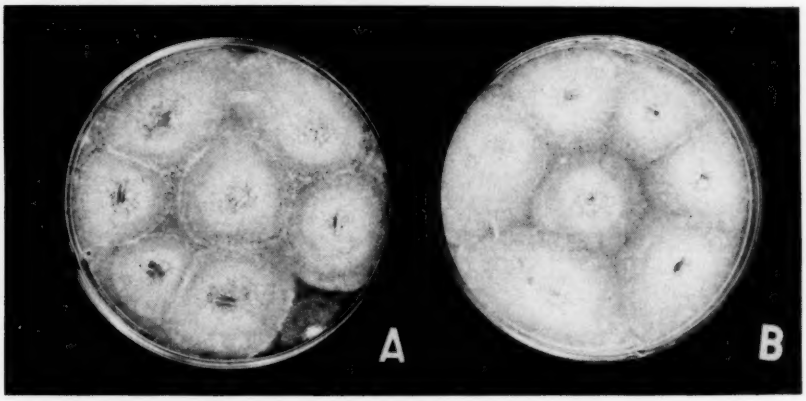


FIGURE 2. The isolation and appearance of Graphium ulmi in the presence and absence of cycloheximide and streptomycin sulfate. A -- Control (no antibiotic). B -- Medium containing 200 ppm cycloheximide and 10 ppm streptomycin sulfate. (One contaminant on control.)

Table 2: Comparison of PDA with and without antibiotics[a] for the isolation of G. ulmi.

	Difco PDA no antibiotic	Difco PDA with antibiotics	Fresh PDA no antibiotic	Fresh PDA with antibiotics
Number of positive G. ulmi isolations	4	5	3	5
Number of cultures with a fungus other than G. ulmi emerging from the chips.	11	3	6	0
Number of air contaminants	28	2	16	7[b]

[a] Cycloheximide at 200 ppm; streptomycin sulfate at 10 ppm.
[b] All were small bacterial colonies.

that the antibiotics may be added to the standard medium prior to autoclaving without apparent loss in activity. It is felt that other laboratories engaged in the routine diagnosis of Dutch elm disease cases by culture may also wish to explore the possible usefulness of the described selective medium.

Literature cited:

1. Anderson, H. W., and David Gottlieb. 1952. Plant disease control with antibiotics. Economic Botany 6 (3): 294-308.
2. Felber, Irma M., and C. L. Hamner. 1948. Control of mildew on bean plants by means of an antibiotic. Bot. Gaz. 110: 324-325.
3. Schneider, I. R. 1954. (Unpublished data).
4. Wiffen, Alma J. 1950. The activity in vitro of cycloheximide (Actidione) against fungi pathogenic to plants. Mycologia 42: 253-258.
5. _____, N. Bohonos, and R. L. Emerson. 1946. The production of an antifungal antibiotic by Streptomyces griseus. Jour. Bacteriol. 52: 610-611.

SECTION OF APPLIED BOTANY AND PLANT PATHOLOGY, STATE NATURAL HISTORY SURVEY, URBANA, ILLINOIS

SAMPLING OAK WILT TREES WITH AN INCREMENT HAMMER

John S. Boyce, Jr.[1]

Surveys for oak wilt in the Southern Appalachians have been conducted by the Southeastern Forest Experiment Station yearly since 1951. Considerable laboratory culturing has been necessary to confirm field diagnosis of suspect trees.

Sampling has consisted of cutting several wilting branches from the crown of the tree with a pole pruner. This procedure is sometimes impossible because of the distance of wilting branches from the ground. Where wilting branches cannot be obtained, chips several inches square with the bark intact are chopped from the trunk of the tree. This method often results in deep and unsightly wounds.

Hubert (2) described the use of the increment hammer for isolating fungi from infected woody tissues. It occurred to the writer that the method might be advantageously used to sample suspected oak wilt trees. Accordingly, nine red oaks, 9 to 22 inches in diameter at breast height, were sampled in May 1956. Wilting and "water-soaked" leaves were present on the trees but none were shedding. The sampled trees were 5 to 30 feet distant from previously wilt-infected trees at six infection centers in eastern Tennessee. Each tree was sampled at three points around its circumference. Small squares of bark were removed and the exposed wood was swabbed with 95% alcohol and flamed. Two increment cores were then removed from each area with an increment hammer. The cutting tube of the increment hammer was dipped in alcohol and flamed just prior to sampling.

One core of each pair was ejected into a test tube containing sterile water, and one core into a tube containing a liquid nutrient medium (1). The cultures were examined 5 and 6 days later after incubation at room temperatures.

The oak wilt fungus Endoconidiophora fagacearum Bretz was isolated from eight of the nine trees sampled. The sterile water tubes yielded the same number of positive cultures as did the liquid nutrient medium. However, there was more conidial production in the latter, which was helpful in identifying the fungus.

In this simple test, the increment hammer method of sampling suspected oak wilt trees was judged to be easy, rapid, and relatively effective.

Literature Cited

1. Barnett, H. L. 1953. Isolation and identification of the oak wilt fungus. West Virginia Univ. Agr. Expt. Sta. Bul. 359T. (As described on page 9 but without the addition of agar.)
2. Hubert, Ernest E. 1954. Isolations of fungi in the field using the Swedish increment hammer. Jour. Forestry 52: 131.

SOUTHEASTERN FOREST EXPERIMENT STATION, FOREST SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

[1] Plant Pathologist, Southeastern Forest Experiment Station, Forest Service, United States Department of Agriculture

HEARTROT IN BOTTOMLAND RED OAKS TWO YEARS AFTER INOCULATION

E. Richard Toole[1]

Fungi causing heartrots are the most destructive disease agents in bottomland hardwood trees. The rate at which the various rot fungi spread often influences the forester in deciding which trees to cut and which to leave, and in setting up basic logging plans for particular forest tracts.

The usual approach to rate-of-spread problems is to dissect a large number of naturally infected trees in which the year of infection can be approximated. A more precise method consists of inserting pure cultures of heartrot fungi into sound trees. The latter method was used to determine the rate of decay of three different rot fungi in bottomland red oaks. Although the study is planned to cover a 10-year period, a report after 2 years is of interest because no other experiments of this type have been undertaken in bottomland hardwoods so far as the writer knows.

Methods

Inoculations were made on 150 bottomland red oak trees on the Delta Experimental Forest, Stoneville, Mississippi. Most of the trees were willow oak (Quercus phellos L.), and the remainder were Nuttall oak (Q. nuttallii Palmer).

Fifty trees were inoculated with pure cultures of Fomes geotropus Cke., 50 with Polyporus fissilis Berk. & Curt., and 50 with Polyporus hispidus Bull. ex Fr. The inoculum was prepared by growing the fungi on sterilized oats for one month. In September 1953, a 1/2-inch hole was drilled into the heartwood of each tree. Immediately after it was drilled, each hole was filled with the inoculum and plugged with a cork.

In September 1954, and again in September 1955, some of the trees were felled and dissected. In addition, isolations were attempted at intervals above and below the limits of visible rot for all trees.

Results

One year after inoculation, F. geotropus and P. hispidus had spread 1.5 $\pm$ 0.7 inches above and below the point of inoculation in the heartwood. P. fissilis had spread up 2.5 $\pm$ 0.42 inches and down 2.6 $\pm$ 0.48 inches from the inoculation hole. These results are from examinations of a total of 8 infected trees.

In September 1955, two years after the inoculations, 24 trees were felled and dissected; of these, 18 had become infected (Table 1). P. hispidus had achieved the greatest spread, but -- at least in this small sample -- the difference between it and other species was not statistically significant.

Table 1. Average spread of visible heartrot in the heartwood of bottomland red oak years after inoculation

Fungus	Trees		Upward spread	Downward spread
	Examined	Infected		
	-- Number --		Inches	Inches
Fomes geotropus	8	7	7.9 $\pm$ 3.32	8.1 $\pm$ 3.13
Polyporus fissilis	8	4	7.2 $\pm$ 2.98	7.2 $\pm$ 2.94
Polyporus hispidus	8	7	9.0 $\pm$ 4.55	8.6 $\pm$ 4.47

[1]Stationed at Delta Research Center, Southern Forest Experiment Station, Forest Service, U. S. Department of Agriculture. The Delta Research Center is maintained in cooperation with the Mississippi Agricultural Experiment Station at Stoneville, Mississippi, and is partially financed by the Southern Hardwood Forest Research Group.

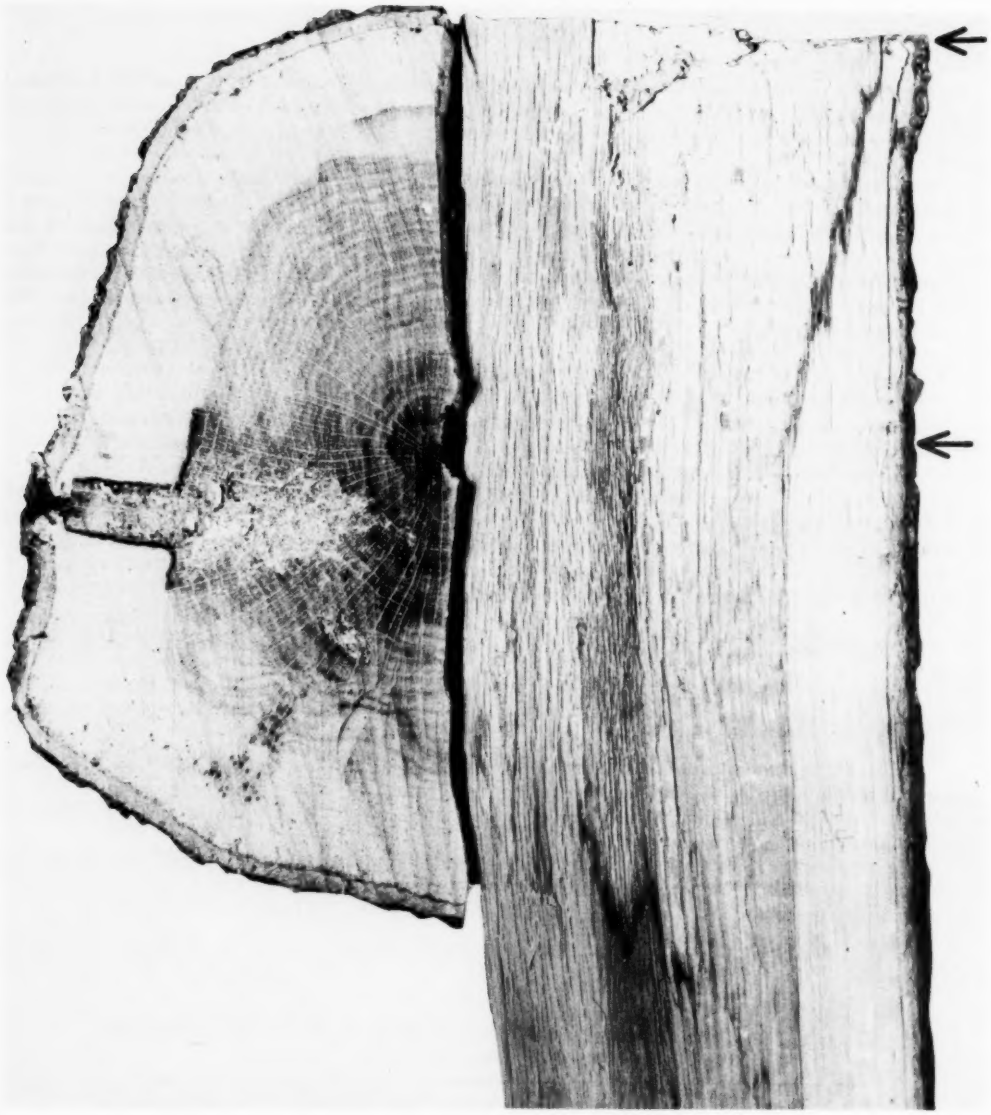


FIGURE 1. Progress of rot in willow oak inoculated 2 years previously with Fomes geotropus. In the longitudinal section at right, the rot extends down 8 inches, as indicated by the distance between the two arrows.

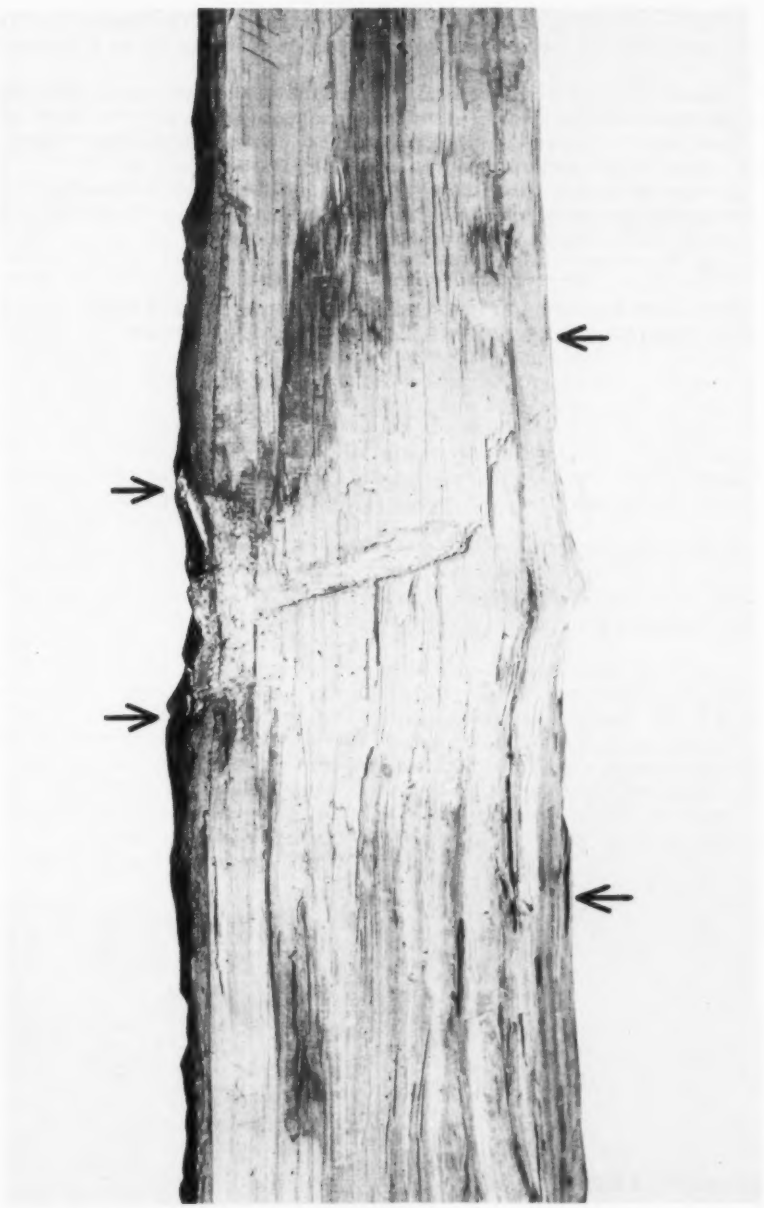


FIGURE 2. Section of a willow oak, 7 inches in diameter, that was inoculated two years ago with a pure culture of Polyporus hispidus. A typical hispidus canker has formed (arrows at left indicate boundaries). White rot has extended both above and below the inoculation hole (limits indicated by arrows on right).

The horizontal spread of infection varied from almost nothing to 6 inches on either side of the inoculation hole. A typical case is illustrated in Figure 1. The fungus used for inoculation was re-isolated from all trees showing rot--in some cases as far as 2 inches beyond the visible decay.

Seventeen percent of the 50 trees inoculated with P. hispidus had small, well-defined cankers around the inoculation holes 2 years after inoculation (Fig. 2). However, on the basis of the trees dissected it is evident that most of the trees inoculated with this fungus have become infected, even though they have not yet developed visible cankers.

These results are, of course, preliminary. It seems likely that the passing of time will reveal differences in the rate at which each species of fungus spreads. It is also possible that the rot may progress more slowly in later years than it has done so far.

DELTA RESEARCH CENTER, SOUTHERN FOREST EXPERIMENT STATION,
FOREST SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

SOME OBSERVATIONS ABOUT POLYPORUS DRYADEUS ON OAK [1]

Charles L. Fergus

Polyporus dryadeus Pers. ex Fries has been reported by Long (4) to be a root parasite of various species of oak including Quercus rubra (red), Q. nigra (water), Q. velutina (black), Q. shumardii var. texana, Q. alba (white), Q. stellata (post), and Q. prinus (chestnut). The fungus was reported as killing roots and ultimately causing the death of the entire tree (3, 4). Although only old or badly suppressed oak trees, or oaks growing on adverse sites were killed, Long (5) later reported the death of young sapling white firs (Abies concolor) in New Mexico due to this pathogen.

Campbell and Miller (1) have recently illustrated the importance of P. dryadeus as a cause of windthrow of oak shade trees in Georgia.

During the summer of 1953 and 1954 the effects of this fungus on oaks were clearly exhibited in State College, Pennsylvania. Two overmature scarlet oaks, Q. coccinea, suddenly died. The foliage turned brown, with all the tissue of a leaf browning at the same time. The dead leaves remained attached to the tree. Culture isolations were made from the xylem of twig and branches, but Endoconidiophora fagacearum Bretz was not obtained. A careful examination of the bases of the trees revealed old disintegrating sporophores of P. dryadeus. When the trees were removed, examination of the root collar and buttress roots revealed decay characteristic of that caused by P. dryadeus (4). Cultural isolations were made from the decayed wood. The cultures obtained agreed with cultures of P. dryadeus as described by Davidson, et al. (2). This report enlarges the host range of the fungus.

An examination of summer rainfall, as recorded by the Meteorology Department, Pennsylvania State University, revealed a 4.1 inch deficit for June, July, and August, 1952, and a 4.9 inch deficit for the summer of 1953. It would therefore appear probable that these trees, with root systems reduced by the action of P. dryadeus, succumbed because of the unfavorable environmental condition of low soil moisture.

During the summer of 1954, a large scarlet oak on the campus of the Pennsylvania State University was windblown by "Hurricane Hazel" (Figs. 1 and 2). Small sporophores of P. dryadeus (Fig. 3) had formed at the base of this tree for several previous summers. The tree was 70 feet tall and 26 inches diameter breast height. Sixteen large roots had been broken about 2 feet below ground and then the tree was literally wrenched out of the ground. Some of the roots that broke were 14 inches and 12 inches in diameter. Cross sections sawn through them showed them to be almost completely decayed (see Fig. 4). When the tree was bucked into logs, it was discovered that the entire trunk was sound except for two small areas of decay found in the section sawn at a 6-inch level above the soil line (Fig. 5).

FIGURE 1. A windthrown scarlet oak, showing roots decayed by Polyporus dryadeus.

[1] Contribution No. 213 from the Department of Botany and Plant Pathology. Authorized for publication on July 30, 1956 as paper No. 2079 in the Journal Series of the Pennsylvania Agricultural Experiment Station.

FIGURE 2. A closer view of the scarlet oak to show the broken decayed roots.

FIGURE 3. A sporophore of P. dryadeus at the base of an oak tree.

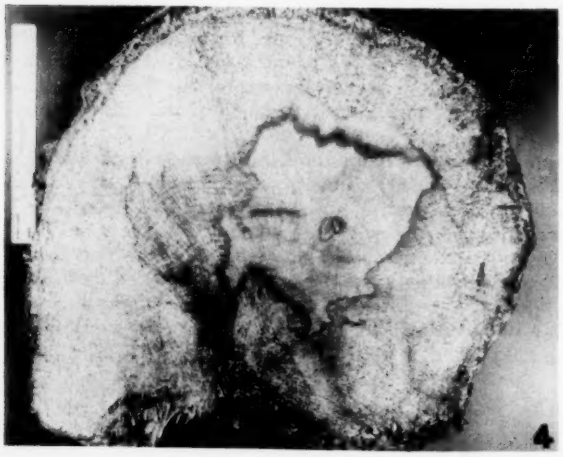


FIGURE 4. Cross section through a decayed root.

FIGURE 5. Cross section through the trunk, 6 inches above the soil line. Only two small areas of decay are visible.

Although Long (3) reported P. dryadeus as a parasite, and able to kill trees, its pathogenicity must be of a rather low degree. The older portion of the root system of this tree was almost completely decayed, including both heartwood and sapwood, yet the bole was sound and the foliage normal in appearance and amount.

Literature Cited:

1. Campbell, W. A., and J. H. Miller. 1952. Windthrow of root-rotted oak shade trees. Plant Dis. Reptr. 36: 490.
2. Davidson, R. W., W. A. Campbell, and D. B. Vaughn. 1942. Fungi causing decay of living oaks in the eastern United States and their cultural identification. U.S.Dept. Agric. Tech. Bul. 785.
3. Long, W. H. 1913. A preliminary note on Polyporus dryadeus as a root parasite on the oak. Phytopathology 3: 285-287.
4. Long, W. H. 1913. Polyporus dryadeus, a root parasite on the oak. Jour. Agr. Res. 1: 239-250.
5. Long, W. H. 1930. Polyporus dryadeus, a root parasite of white fir. Phytopathology 20: 758-759.

THE DEPARTMENT OF BOTANY AND PLANT PATHOLOGY, PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK, PENNSYLVANIA

NEW AND UNUSUAL RECORDS AND OTHER BRIEF NOTES ON PLANT DISEASES

SOYBEAN CYST NEMATODE FOUND IN NEW AREA

By Joseph F. Spears, F. I. Bowen, and C. D. Bowers

Soybean cyst nematode, Heterodera glycines Ichinohe, was tentatively identified as the primary cause of death of soybean plants in the field 3 miles south of Burgaw, North Carolina, July 31, 1956, by F. I. Bowen and C. D. Bowers. The owner of the property on which the nematode was found reported July 30, 1956, that he believed this nematode was "burning up" his crop, and requested a confirmation of his diagnosis.

This infested property is 19 miles north of extensive infestations at Wrightsboro, North Carolina. Another center of infestations is located at Castle Hayne, North Carolina, approximately 5 miles north of Wrightsboro. Between these three centers of infestation there are approximately 484 properties which are regarded as not infested with this nematode, because nearly 10,000 composite soil samples comprising 560,000 subsamples have been collected on an 8 x 8 meter grid pattern, on 6,867 acres on these farms during the past year without a soybean cyst nematode being found in them. The infested areas comprise 79 properties and 1,687 acres. All of the infested properties at Wrightsboro belong to one family. A State Quarantine is in effect in the Castle Hayne area.

PLANT PEST CONTROL BRANCH, AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE, WILMINGTON, NORTH CAROLINA

[1] Coordinator, Nematode Control Programs, Plant Pest Control Branch; [2] Agriculturist (Survey Supervisor, Soybean Nematode Control), Plant Pest Control Branch; and Agriculturist (Assistant Laboratory Supervisor, Soybean Nematode Laboratory), Plant Pest Control Branch, Agricultural Research Service, United States Department of Agriculture, Wilmington, North Carolina.

[2] Agricultural Research Service, United States Department of Agriculture, Hicksville, NewYork.

BACTERIAL LEAF SPOT OF ALFALFA IN IOWA

By Raymond D. Brigham

A bacterial leaf spot, resembling that caused by Xanthomonas alfalfae (Riker, Jones, & Davis) Dowson was observed on alfalfa at the Iowa State College Agronomy Farm, Ames, Iowa, on June 19, 1956. The disease occurred chiefly on a clonal selection from Cossack alfalfa. This selection was seriously infected in each replication, and only slight infection occurred in other selections from Cossack. The space-planted nursery in which this disease was found was well isolated from other alfalfa fields. The nursery was established from rooted cuttings in May, 1955. No other fields of alfalfa at the Agronomy Farm showed evidence of the disease.

This is believed to be the first report of the occurrence of this disease in the United States since it was originally described in 1935. Further studies of the organism are in progress.

As of August 7, the bacterial leaf spot continues to persist in the plots where it was originally observed.

DEPARTMENT OF BOTANY AND PLANT PATHOLOGY, IOWA STATE COLLEGE, AMES, IOWA

A NEW HOST FOR SCLEROPHTHORA MACROSPORA

By Timothy A. Gaskin and Michael P. Britton

Alta fescue, Festuca elatior L. var. arundinacea Hackel, was found near Lafayette, Indiana, with typical symptoms of crazy top caused by Sclerophthora macrospora (Sacc.) Thirum., Shaw. & Naras. Sections of stems revealed the presence of oospores of the fungus. Symptoms included proliferation of the florets, shortening of the flower pedicel, and, more rarely, the production of vegetative shoots from the flower head. The infected plants were found in a low, wet part of the field. This is apparently the first report of this fungus attacking Alta fescue.

DEPARTMENT OF BOTANY AND PLANT PATHOLOGY, PURDUE UNIVERSITY, LAFAYETTE, INDIANA.

FLOWER BLIGHT OF CAMELLIA IN SOUTH CAROLINA

By L. W. Baxter and J. A. Berly

Certain camellia flowers exhibited at two separate shows in South Carolina were observed by show officials to be affected by some disease foreign to camellia enthusiasts of this State. Investigations made at the locations from which the blooms originated revealed that many camellia blossoms were similarly affected. A careful examination of the soil underneath several established camellia plants in these gardens disclosed an abundance of apothecia and attached sclerotia which were identified as the fruiting structures of Sclerotinia camelliae Hara, the cause of flower blight of camellia. The widespread distribution of the disease within the affected gardens suggests that flower blight has been present in these areas for a period of two or more years. One of the owners of an infested garden in Sumter County stated that he had noticed similarly affected flowers in his garden for at least 4 years.

The exact distribution of the disease within the State is unknown, but presently flower blight has been found on five separate properties representing three counties, Sumter, Dorchester, and Florence. This is the first report of flower blight of camellia in South Carolina.

Results of extensive investigations in two separate gardens, each having 100 or more varieties, failed to disclose any variety possessing resistance to infection by Sclerotinia camelliae. It is not known, however, whether or not all these varieties favor sclerotial development equally well.

All Sclerotinia isolates obtained from diseased flowers proved to be Sclerotinia camelliae and not S. sclerotiorum. One interesting observation revealed that some diseased flowers, either lodged in branches or nonabscised, had formed mature sclerotia in situ. Suggested control measures usually include the removal and destruction of fallen flowers before sclerotial formation.

It would thus seem advisable, during periodic removal of fallen flowers, to survey the plants carefully for diseased flowers and remove any that are found.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION AND CROP PEST COMMISSION.

A NOTE ON THE CITATION OF THE BEAN ANTHRACNOSE FUNGUS

By John A. Stevenson

It has been customary for most workers to cite the bean anthracnose fungus as Colletotrichum lindemuthianum (Sacc. & Magn.) Briosi & Cavara. It was originally published as Gloeosporium lindemuthianum Sacc. & Magn. Michelia 1: 129. 1878. F. Lampson Scribner (Report of Chief of the Section Veg. Path. U. S. Dept. Agric. 1887, p. 364. 1888) was apparently the first to point out that the fungus was more properly a Colletotrichum, although he did not make a formal new combination as the present International Code of Botanical Nomenclature would require today. However, many a "new combination" set up in the same informal style has been picked up and come into general use.

Briosi and Cavara in the text accompanying an exciccati specimen of this species (I funghi parassiti delle piante coltivati od utili, No. 50. 1889.) noted that Scribner had said that the species should be placed in Colletotrichum and proceeded to make a formal transfer citing themselves as the authors of the new combination. In the meantime, Scribner (Orchard and Garden 11: 193-194. Oct. 1889) had again published on the fungus, definitely using the binomial Colletotrichum lindemuthianum. Since Briosi and Cavara studied material collected in the summer of 1889 ("estate 1889") their resulting publication almost surely was later than the second Scribner paper. It would appear in order therefore to cite the fungus as C. lindemuthianum (Sacc. & Magn.) Scribner. This manner of citation has been used by Duggar (Fungous diseases of plants, p. 322. 1909) and some other workers in the years since.

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

ATTENTION PLEASE!

35TH ANNUAL REPORT OF THE CANADIAN PLANT DISEASE SURVEY, 1955

The 35th Annual Report of the Canadian Plant Disease Survey for the year 1955 has been compiled and published and is now ready for distribution.

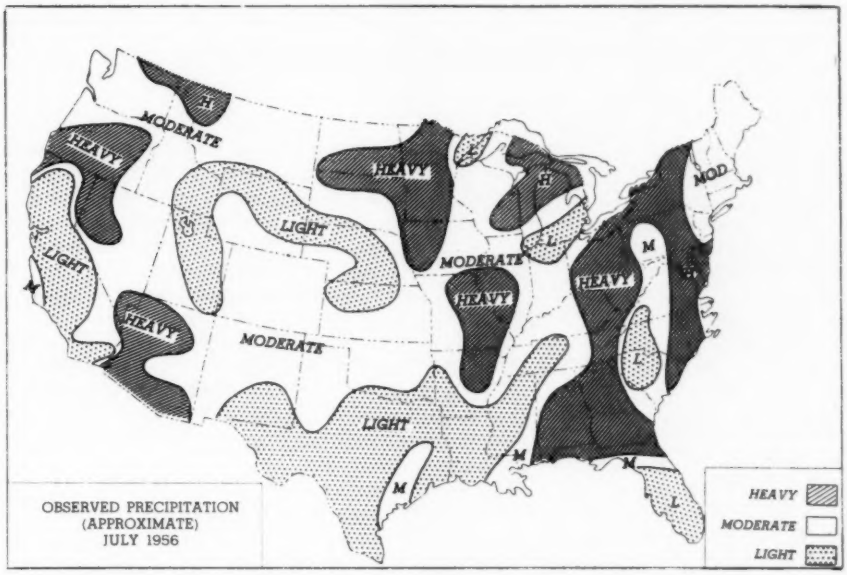
These reports attempt to summarize the plant disease situation in Canada on an annual basis. They contain also a number of special reports that provide information in considerable detail on diseases of certain crops.

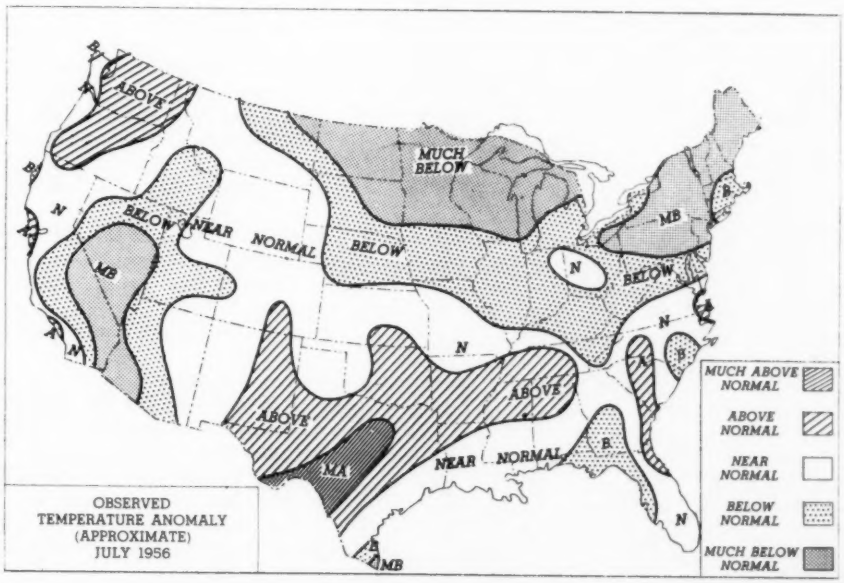
Besides the copies that go to libraries of agricultural colleges and plant pathology departments, a limited number is available for distribution to individuals. If there are readers of the Reporter, who would like to receive a copy of the 35th Report for their personal use or wish to have their name placed on the Survey mailing list, address your request to the undersigned, Botany and Plant Pathology Division, Science Service Bldg., Ottawa, Ont., Canada.

I. L. Conners

A CORRECTION

August REPORTER, article by Wm. Bridge Cooke pages 681-687: in the bibliography the reference for Greenberg and Thomas should be corrected to read 26: 761-770 (instead of 70: 689-694).





The terms used in the accompanying maps, which define the ranges of temperature and precipitation, are numerical class limits. These are based on a statistical analysis of past records through which is determined the normal frequency of occurrence of temperatures and precipitation at various times of the year for different locations. For temperature the classes above, below, and near normal are so defined that they each normally occur one-fourth of the time; much above and much below normal, one-eighth of the time. Precipitation is depicted in terms of light, moderate, and heavy, each class normally occurring one-third of the time and thereby having equal probability of occurrence. These maps graphically represent only the general trends and give the country's weather picture at a glance. For quantitative studies, where monthly mean temperatures and actual precipitation records are needed for a given time and place, other publications of the Weather Bureau should be consulted. P. R. M.

MANUSCRIPTS FOR THE PLANT DISEASE REPORTER

(See also PDR 35: 121-122; 36: 214, 494)

(1) GENERAL: The Reporter page measures 9 inches long with the heading or 8 3/4 inches for the text part, by 6 inches wide. The copy is typed on a larger page, 11 1/4 inches of text or 12 inches overall in length by 8 inches in width, and reduced 25 percent in the photographic process of reproduction. Illustrations or tables larger in either dimension will take a correspondingly greater reduction. Only one size of type is available for text, footnotes, or tables.

(2) MANUSCRIPTS should be the original ribbon copy, not carbons, clearly typed and double-spaced throughout, including tables, footnotes, and bibliographies. (Note -- only one copy is needed.) Footnotes should be typed at the bottom of the page.

(3) ABSTRACTS are requested for all except very short articles. (PDR 38: 316).

(4) CAUSES OF DISEASES should be named. For bacteria, fungi, nematodes, etc., give the Latin name of the organism; for viruses either or both the accepted common name of the virus or a Latin name if you prefer it and there is one; for non-parasitic diseases state the causal factor if it is known. If the cause of a disease has not been determined say so. (PDR 36: 494).

(5) LITERATURE REFERENCES should be given in alphabetical order and numbered for citation in the text. We follow the AIBS suggestion of placing the year of publication after the author's name. Please check your titles carefully since we cannot do it for you. Be sure that text citations and bibliography agree; that foreign-language references are correct; that number or month is cited for periodicals that are not paged consecutively throughout the volume.

(6) NAMES OF FUNGICIDES should be given according to the suggestions that will be published in Phytopathology before long, and later repeated in the Reporter. In the meantime see PDR 35: 122.

(7) ILLUSTRATIONS should be sent to us unmounted. To prevent mistakes, write figure numbers on the back, and mark the top of each print when necessary. A sketch can show a preferred arrangement but please keep in mind page size, shape, and standard reduction (see above under General), and remember that figure titles and legends are part of the page. Lettering should be clear and large enough to be legible after reducing. Drawings, maps, and graphs can be photographs or originals, but should be finished and ready for reproduction, not just sketches.

(8) TABLES should be carefully thought out with particular attention to the Reporter's limitations in reproduction. Make titles and headings definite and self-explanatory. Designate footnotes in tables with superscript lower-case letters. Be sure that text discussion agrees with the data in the table. Do not abbreviate names of crop varieties.

(9) REPRINTS cannot be supplied since there is no way in which we can be reimbursed. However,

(10) The MULTILITH PLATES from which reprints can be made will be sent if requested at the time the article is submitted. The press size of these plates used for the Reporter is designated as small -- maximum image 9 1/2 by 13 inches, maximum paper size 9 3/4 by 14 inches -- for Model 1250. Most of the Experiment Stations have this type of multilith machine.

(11) We are the official correspondents in the United States of the PLANT PROTECTION BULLETIN published monthly by the United Nations Food and Agriculture Organization. We would appreciate it if plant pathologists would send us suitable material from time to time for inclusion in our monthly summary reports. Please mark it clearly so that we will know it is intended for the Bulletin. (See PDR 36: 492; 37: 637) -- P. R. M.